CONTROL DATA®
PAPER TAPE PUNCH

National Cash Register Company
Model NCR EM-B2
Paper Tape Punch

DESCRIPTION OF EQUIPMENT
EQUIPMENT SPECIFICATIONS
IMPLEMENTATION DATA
SERVICE DATA
PARTS LIST

CONTROL DATA CORPORATION

CUSTOMER ENGINEERING MANUAL

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(Includes Rev. 1; describes Transport decks beginning with Serial No. 7342834, and EM-B1 Punch Heads beginning with Serial No. 7506262)

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AMENDMENT TO MANUAL MX-1027-7

UNIT DESIGNATION CHANGE

The complete Paper Tape Punch described in this manual will no longer be known as the EM-B2. The Punch Head will be known as the EM-B1. The Tape Transport Assembly (less the Punch Head) will now be known as the EM-B2.

These items are considered as separate components and if a Paper Tape Punch Head and Transport are required, they should be ordered as separate items (i.e., an EM-B1 and an EM-B2).

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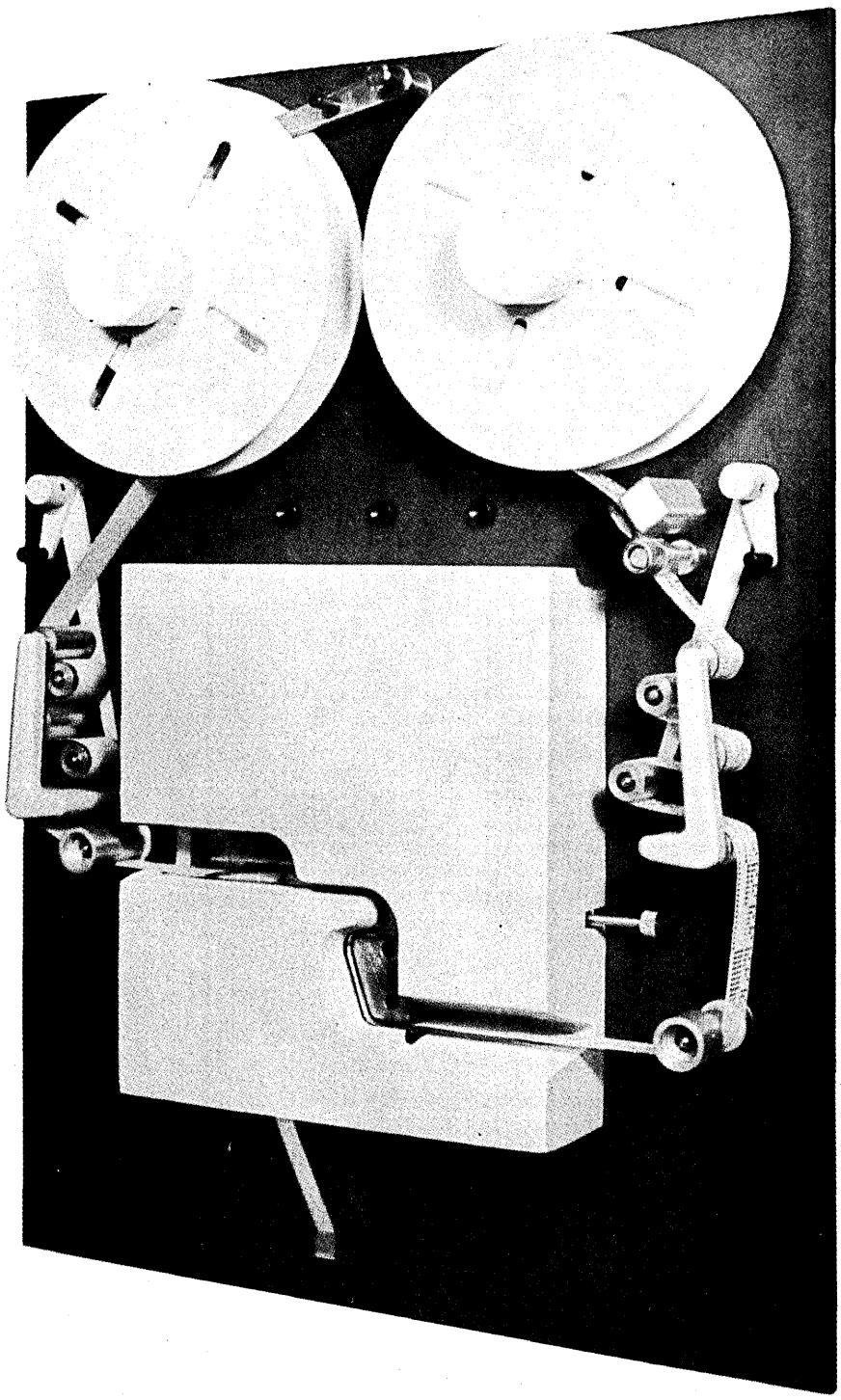


FIGURE 1-1. NCR EM-B2 PAPER TAPE PUNCH.

SECTION 1. DESCRIPTION OF EQUIPMENT

1.0 INTRODUCTION

This manual provides operation and service information for the NCR EM-B2 Paper Tape Punch. The EM-B2, shown in Figure 1-1, is a high-speed paper tape punch designed for use with Electronic Data Processors which require a punched paper tape output. In response to commands from the associated Electronic Data Processor, the EM-B2 punches paper tape at a speed of 120 characters per second. The EM-B2 can punch paper tape which is either 11/16 inch (5 channels), 7/8 inch (5 or 7 channels), or 1 inch (5, 7, or 8 channels) in width. Either oil or dry paper tape can be used. Paper-mylar-paper tape can also be used, but may shorten punch life if used exclusively. The tape punch is designed for installation in a parent unit.

The EM-B2 Paper Tape Punch is composed of two units: the Tape Transport Assembly and the EM-B1 Punch Head. In the remainder of this manual, the EM-B2 will be referred to as the Tape Punch, the Tape Transport Assembly will be referred to as the Tape Transport, and the EM-B1 Punch Head will be referred to as the Punch Head.

This section of the manual describes the theory of operation of the Tape Punch. The theory of operation is divided into three parts: block diagram analysis, mechanical description, and electrical description.

1.1 BLOCK DIAGRAM ANALYSIS

Figure 1-2 is a block diagram of the Tape Punch showing the inputs and outputs of the two major units. The following paragraphs present a discussion of this block diagram.

1.1.1 Tape Transport. The Tape Transport contains tape supply and tape take-up mechanisms. The tape supply mechanism supplies paper tape to the Punch Head from a motor driven tape reel. The operation of the tape supply motor is controlled by two microswitches which are actuated by a sensing cam attached to the tape supply control arm shaft. The control arm forms a loop of tape between the supply reel and Punch Head that isolates the inertia of the supply reel from the Punch Head. One of the microswitches controls the supply motor so that it alternately drives and brakes the supply reel to maintain a nearly constant tape loop between the reel and Punch Head. The other microswitch provides an output signal (supply latch) when tape is being loaded. This signal may be used to remove operating power from the supply and take-up motors and to inhibit punch instructions from the Processor. When the tape supply is low, a tape low sensing arm provides an output signal (tape low) which may be used to inhibit punch instructions from the Processor.

As punched tape is fed from the Punch Head, it is wound on a take-up reel driven by a stallable motor. The tape take-up operation is controlled by two microswitches which are actuated by a sensing cam attached to the take-up control arm shaft. One of the microswitches operates a tape brake which alternately brakes and

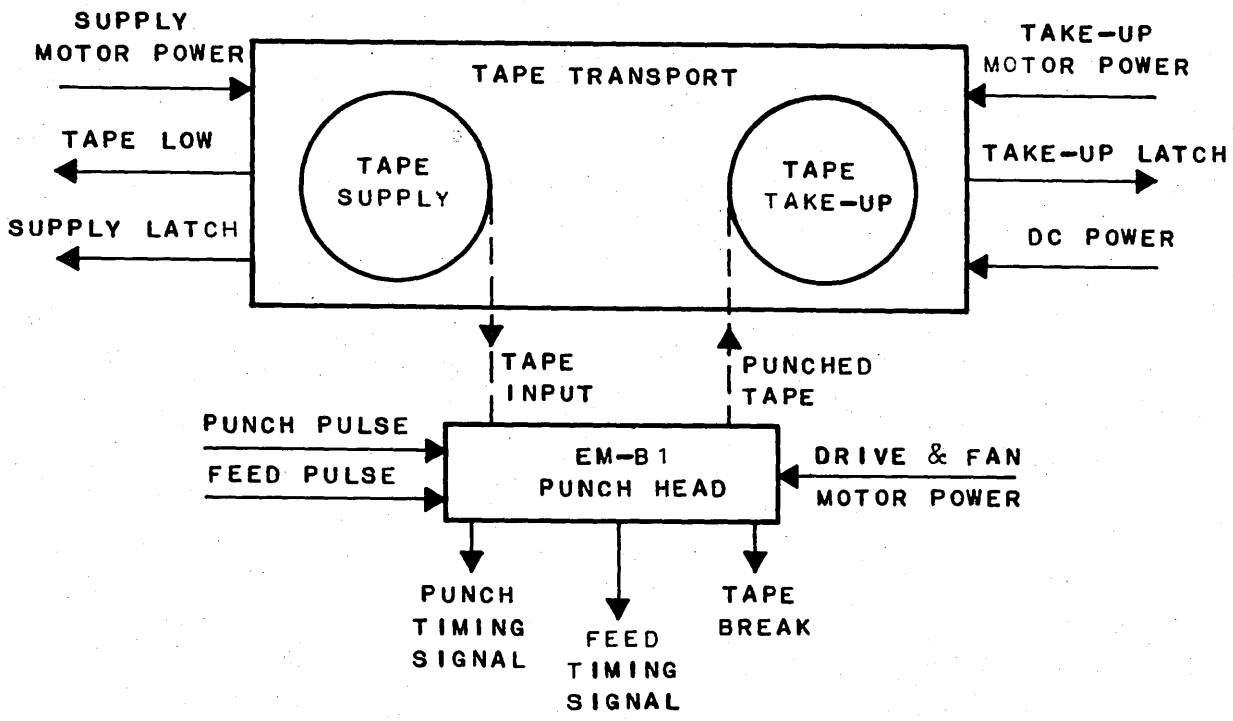


FIGURE 1-2. EM-B2 PAPER TAPE PUNCH, BLOCK DIAGRAM.

passes the tape to isolate the take-up reel and punch head and to maintain proper tension. Maintenance of proper tension prevents elongation of feed sprocket holes and loose winding of the tape on the tape reel. The other microswitch provides an output signal (take-up latch) when tape is being loaded. This signal may be used to remove operating power from take-up and supply motors and to inhibit punch instructions from the Processor.

1.1.2 Punch Head. The Punch Head punches paper tape in accordance with instructions received from the Processor. These instructions are in the form of punch and feed pulses. Timing signals are furnished by the Punch Head to the Processor to insure that the punch and feed pulses are synchronized with the mechanical cycle of the punching mechanism. The Punch Head also detects broken tape at its input and provides a broken tape output signal which may be used to inhibit punching instructions from the Processor.

1.2 MECHANICAL DESCRIPTION

The description of the mechanical operation of the Tape Punch is divided into two parts: Tape Transport and Punch Head. There is no mechanical linkage between the two major units, with the exception of the paper tape being punched.

1.2.1 Tape Transport. The mechanical functions of the Tape Transport can be divided into three basic operations. These operations are:

1. Tape Supply
2. Tape Low Sensing
3. Tape Take-up

1.2.1a Tape Supply. Paper tape is supplied to the Punch Head from the motor driven supply reel located in the upper left corner of the mounting plate as shown in Figure 1-3. Rolls of tape wound on standard paper cores are loaded on the supply roll hub by removing the supply reel flange. The supply reel flange is easily removed from or placed on the supply reel shaft with a firm pull or push. Three detents in the supply reel shaft hold the flange in the correct position on the shaft for the three standard widths of paper tape. The roll of tape is placed over the supply roll hub so that tape is removed from the roll when the supply reel rotates clockwise.

To load tape in the Punch Head, the supply control arm is rotated clockwise until the cutout in the supply sensing cam, shown in Figure 1-4, engages the supply latch arm. This occurs when the control arm is at the left of the supply idlers. Paper tape is then pulled from the roll on the supply reel, passed between the control arm and the supply idlers, under the adjustable idler at the left of the Punch Head, and loaded into the Punch Head so that a few feet of excess tape is available for loading on the take-up side of the Tape Punch. When tape has been loaded in the Punch Head, the tape supply loops are formed by pressing the left latch release button. This disengages the supply latch arm and the supply sensing cam and allows the spring attached to the sensing cam to return the supply control arm to its stop, forming the tape supply loop as shown in Figure 1-3.

When the supply sensing cam and the supply latch arm are engaged, the supply sensing cam actuates microswitches SC303 and SC305. The closing of the SC303 contacts may be used to signal the Processor to inhibit its punch and feed line outputs. The closing of the SC303 contacts may also be used to prevent 115v from being applied to the supply reel and take-up motors. This allows the take-up and supply reels to rotate freely so that paper tape can be pulled from the supply reel and wound on the take-up reel easily.

When the supply sensing cam and the supply latch arm are disengaged, the spring attached to the sensing cam causes the cam to rotate clockwise, as viewed from the rear of the mounting plate, until the control arm reaches its stop. In this position the supply sensing cam is not in contact with the actuator of SC303 and is not actuating SC305.

When the Punch Head starts punching paper tape, SC305 is not actuated and the normally closed contacts of relay K301 complete a circuit which applies about 8v DC to the supply reel motor. Braking of the motor is initially accomplished by the discharge of a capacitor. The 8v DC applied to the motor holds the motor so that as tape is punched, the tape supply loop is shortened causing the supply control arm to move away from its stop. After several inches of paper tape has been punched, the movement of the supply control arm will rotate the supply sensing cam far enough in a counterclockwise direction, as viewed from the rear of the mounting plate, to actuate SC305. When SC305 is actuated, its normally-closed contact disconnects 8v DC from the supply reel motor and its normally-open contact connects 115v to the supply reel motor. This causes the motor to drive the tape reel clockwise at about 100 RPM supplying tape to the Punch Head faster than its maximum speed of 12 inches per second. This allows the tape loop to lengthen and the supply control arm rotates counterclockwise toward its stop. Before the control arm reaches its stop, the rotation of the supply sensing cam releases SC305. With SC305 in its normal position, 115v power is disconnected from the supply reel motor and 8v DC is re-applied. This brakes

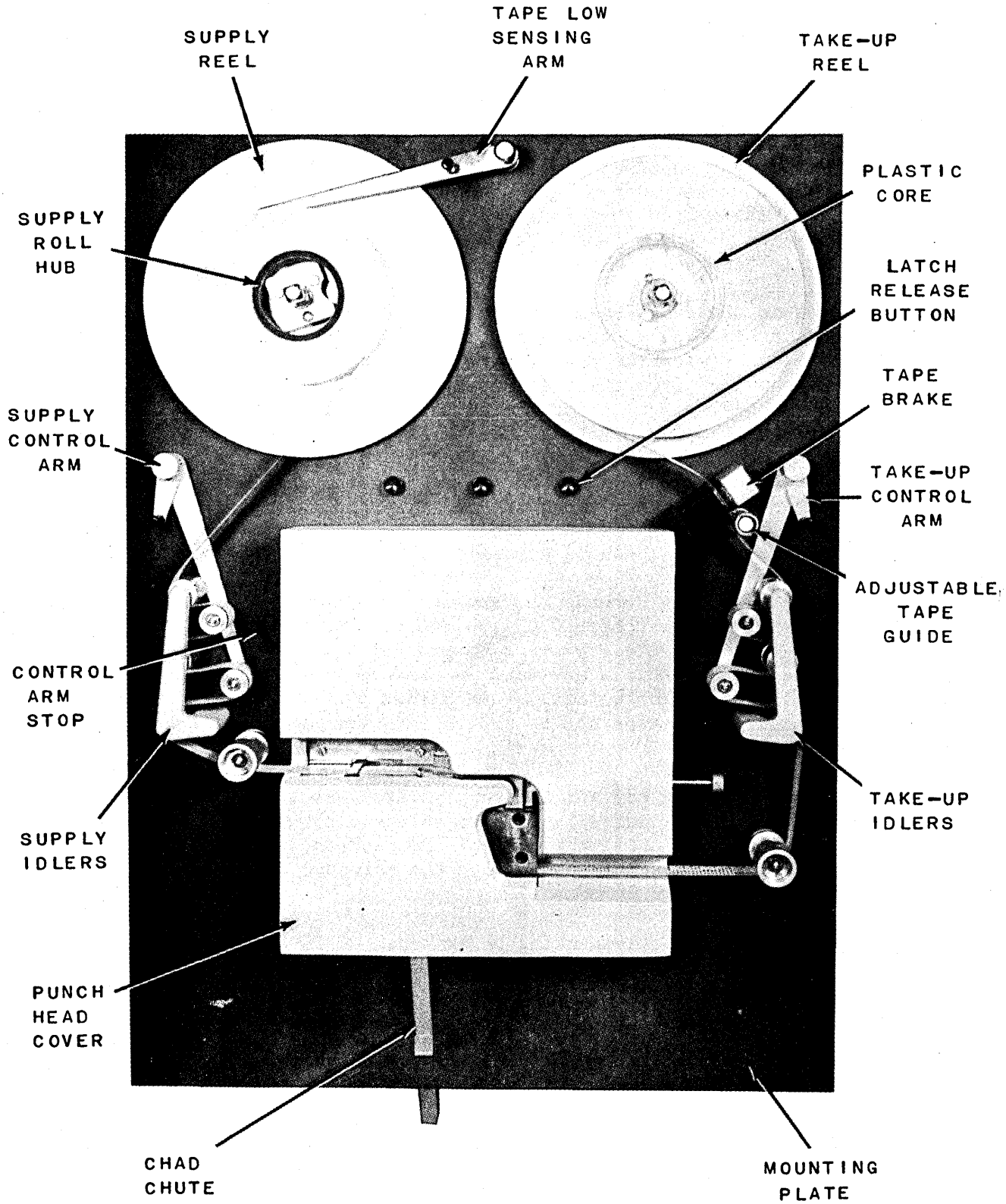


FIGURE 1-3. TAPE TRANSPORT, FRONT VIEW

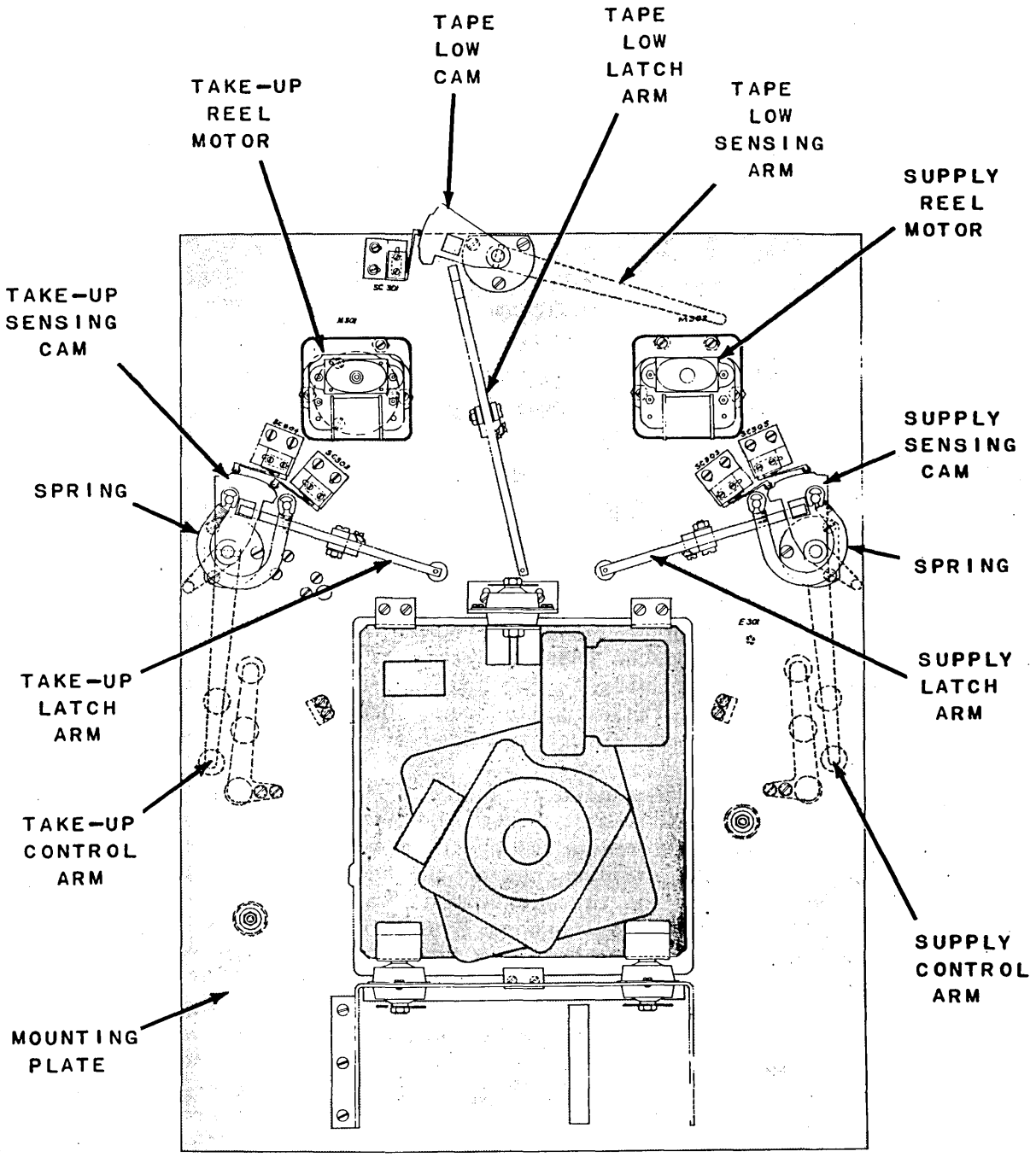


FIGURE 1-4. TAPE TRANSPORT, PARTIAL REAR VIEW.

the motor so that the supply control arm moves away from its stop as tape punching continues. This process of alternately braking and driving the tape reel continues for as long as the Punch Head is punching tape. The spring attached to the supply sensing cam offers only the slightest resistance to rotation of the supply control arm and the braking and driving action of the supply reel motor effectively isolates the inertia of the supply reel from the Punch Head. Thus, the drag on the Punch Head's feed mechanism is minimal and the elongation of feed sprocket holes due to inertia in the tape supply mechanism is well within tolerable limits.

If tape should break between the supply reel and the Punch Head, the supply control arm will return to its stop. This causes the supply sensing cam to release SC305 so that 115v power is removed from the supply reel motor and 8v DC is applied to the motor. This brakes the supply reel and prevents the spillage of tape that would occur if the reel was allowed to continue to rotate.

1.2.1b Tape Low Sensing. The tape low sensing mechanism provides an output indication to the Processor when the supply of tape on the supply reel is nearly exhausted or when tape is being loaded on the supply reel. The tape low sensing arm rides on the roll of tape on the supply reel as shown in Figure 1-3. The right end of the sensing arm is attached to a shaft which passes through the mounting plate. A tape low cam is also attached to the shaft as shown in Figure 1-4.

With an adequate supply of tape on the supply reel, the tape low cam actuates microswitch SC301 as shown in Figure 1-4. As tape is used, the sensing arm falls and the tape low cam rises. When the supply of tape is nearly gone, the lower indentation on the tape low cam is opposite the actuator of SC301 allowing SC301 to return to its normal condition. The normally-open contacts of SC301 may be used to signal the Processor to stop sending punch and feed signals to the Tape Punch.

The tape low cam may also be used to prevent the Processor from sending punch and feed signals to the Tape Punch when a new roll of tape is being loaded on the supply reel. Before the roll is loaded, the operator raises the tape low sensing arm until the cutout in the tape low cam engages the tape low latch arm. When this occurs, the upper indentation on the tape low cam is in contact with the actuator of SC301, allowing SC301 to return to its normal position. With the tape low cam latched, the sensing arm is suspended above the supply reel so that a roll of tape may be loaded on the supply roll hub.

After tape has been loaded, the operator disengages the tape low cam and the tape low latch arm by pressing the center latch release button on the front of the mounting plate. The weight of the tape low sensing arm causes it to fall until it strikes the roll of tape on the supply reel. In this position, the tape low cam actuates SC301. Now the normally-open contacts of SC301 are closed, indicating to the external circuit that sufficient tape is now available for punching.

1.2.1c Tape Take-up. The tape take-up mechanism takes up paper tape as it is fed from the Punch Head and stores it on the tape take-up reel located in the upper right corner of the mounting plate as shown in Figure 1-3. The take-up reel is driven by a 115v, 60 cps (or 50 cps) stallable motor which is mounted on the rear of the mounting plate as shown in Figure 1-4. The take-up control arm, the take-up idlers, and the tape brake, all located between the take-up reel and the Punch Head, ensure that punched paper tape is fed freely from the Punch Head by preventing the high torque developed by the take-up motor from being felt at Punch Head's feed mechanism.

To load tape on the take-up side of the Punch Head, the take-up control arm is moved away from its stop until the cutout in the take-up sensing cam, shown in Figure 1-4, engages the take-up latch arm. With the take-up latch arm and the take-up sensing cam engaged, microswitches SC302 and SC304 are actuated and the take-up control arm is to the right of the take-up idlers. The closing of SC302 contacts may be used to signal the Processor to inhibit its punch and feed line outputs, to disconnect power from the brake solenoid, and cause 115v power to be disconnected from the take-up motor as well as the tape supply control circuit. Actuating SC304, opens a part of the circuit that energizes the tape brake coil. The take-up reel flange is then removed with a firm pull and a standard plastic core having the same width as the paper tape being loaded is slipped over the take-up reel shaft as shown in Figure 1-3. Paper tape coming from the right of the Punch Head, is then passed under the adjustable idler at the right of the Punch Head, between the take-up control arm and the take-up idlers, between the tape brake solenoid and tape brake shoe assemblies, and wound on the plastic core as shown in Figure 1-3. The tape take-up loop is then formed by pressing the right latch release button. This disengages the take-up latch arm and the take-up sensing cam allowing the spring attached to the sensing cam and the mounting plate to return the take-up control arm to its stop forming the tape take-up loop.

When the take-up control arm is against its stop, the take-up sensing cam is not in contact with SC302 and is not actuating SC304. With SC304 released, its normally-open contact opens the circuit that energizes the tape brake solenoid. As tape is wound on theplastic core, the tape loop formed by the take-up control arm shortens causing the control arm to move away from its stop. Since the take-up sensing cam rotates on the same shaft as the take-up control arm, it will rotate in a clockwise direction, as viewed from the rear of the mounting plate. After several inches of tape has been wound on the plastic core, the take-up sensing cam actuates SC304. When this happens, the normally-open contacts of SC304 close to complete the tape brake solenoid circuit. When the tape brake solenoid is energized, the tape brake shoe is attracted to the brake solenoid assembly. The pressure exerted on the tape passing between the brake solenoid assembly and the brake shoe is sufficient to prevent the take-up reel motor from turning the take-up reel. The take-up mechanism will remain in this condition as long as tape is not being punched by the Punch Head.

When the Punch Head starts to punch paper tape, the punched tape fed from the Punch Head lengthens the tape loop. This allows the take-up control arm to move towards its stop. Before the control arm reaches its stop, the rotation of the take-up sensing cam will release SC304. When SC304 is released, its normally-open contacts open the tape brake solenoid circuit. With the tape brake solenoid de-energized, the tape reel motor causes the tape reel to rotate clockwise winding tape on the reel. Again, the tape loop formed by the take-up control arm and take-up idlers shortens and the control arm moves away from its stop until the take-up sensing cam actuates SC304. When this occurs, the tape brake solenoid is energized and the tape loop is allowed to lengthen. This sequence of events is repeated for as long as punched tape is fed from the Punch Head. When punching stops, the control arm will return to a position which actuates SC304 so that the brake solenoid will be energized.

1.2.2 Punch Head. The mechanical functions of the Punch Head can be divided into five basic operations. These operations are:

1. Punch Head Drive
2. Timing Pulse Generation
3. Tape Punching

4. Tape Feeding
5. Tape Break Detection

Figure 1-5 is a functional block diagram of the Punch Head. Electrical power neces-

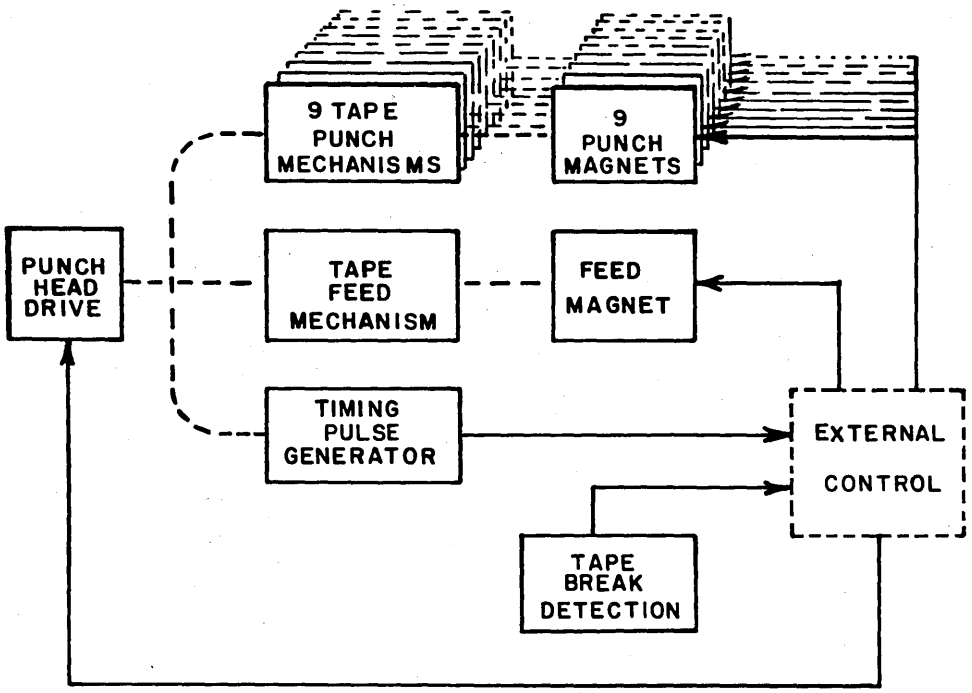
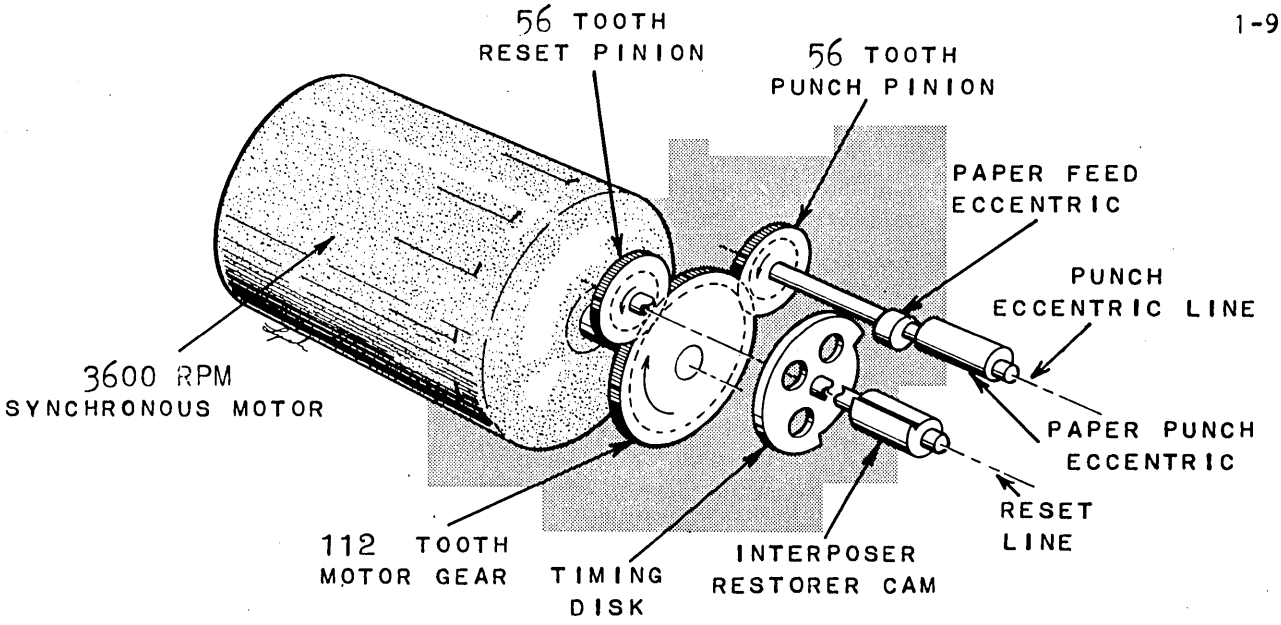


FIGURE 1-5. PUNCH HEAD, BLOCK DIAGRAM.

sary for operation of the Punch Head must be provided by an external control. The punch head drive provides the mechanical motion necessary for operation of the tape punch, tape feed, and timing pulse generation mechanisms. The output of the timing pulse generator provides the external control with an electrical reference to the mechanical position of the punch head mechanisms. Electrical signals developed by the external control can then be delivered to the punch magnets and the feed magnet at the proper time in the cycle of the punch and feed mechanisms to cause punching and feeding of paper tape.

If paper tape breaks or if no paper tape is loaded in the Punch Head, the tape break detector presents either an open or closed circuit to the external control, depending upon the method of external connection. The external control responds by removing the electrical inputs to the Punch Head.

1.2.2a Punch Head Drive. The Punch Head drive mechanism is shown in Figure 1-6. The prime mover of the Punch Head mechanisms is the 60 rps (3600 rpm) synchronous drive motor. The motor rotates clockwise as viewed from the shaft end. A 112 tooth helical motor gear is attached to the drive motor shaft. (If 50 CPS operation is employed, the speed of the reset line and punch eccentric line could be less than the desired 120 rps (7200 rpm). To increase the speed during 50 CPS operation, a 135 tooth motor gear is used in place of the 112 tooth motor gear.) The motor gear meshes with and drives two 56 tooth helical gears. One of the driven gears, the reset pinion, is attached to the interposer restoring camshaft (also called the reset line). The other driven gear is attached to the punch eccen-



*Optional 135 Tooth Motor Gear for 50 CPS operation.

FIGURE 1-6. PUNCH HEAD DRIVE.

tric line. Thus, when power is applied to the drive motor by the external control, both the reset line and the punch eccentric line rotate counterclockwise at a speed of 120 rps (7200 rpm).

The two eccentrics on the punch eccentric line, the paper punch eccentric and the paper feed eccentric, impart simple harmonic motion to the nine punch levers of the paper punch mechanism and to the feed pawl arm of the feed mechanism. The paper punch eccentric passes top dead center 22-1/2 degrees after the paper feed eccentric passes bottom dead center.

The timing disk of the pulse generator is mounted on the shaft of the reset line. Its function is discussed fully in the next paragraph. The interposer restorer cam on the reset line insures that the paper punch channels which are activated during a punch cycle are de-activated at the beginning of the next punch cycle.

1.2.2b Timing Pulse Generation. The timing pulse generator of the Punch Head is illustrated in Figure 1-7. It consists of the timing disk mounted on the reset line and two electromagnetic pickups (also called reluctance heads). The electromagnetic pickups are mounted on the rear frame of the punch head so that the clearance between the rim of the timing disk and the electromagnetic pickups is 0.004 $\pm$0.0005 inch and the angle between the two pickups is 65°.

The timing disk is cut from 3/32 inch cold drawn steel. It is 2-3/8 inches in diameter and has a 7/32 inch deep cut into 144° of its rim. Each electromagnetic pickup contains a coil of fine wire wound on a permanent magnet core. Any change in magnetic flux in the core will induce a voltage in the coil. When the leading edge of the cut in the timing disk passes an electromagnetic pickup, the flux in the core of the pickup decreases and induces a voltage pulse in the pickup winding. When the trailing edge of the cut passes the pickup, the magnetic flux in its core increases. This induces a voltage pulse in the pickup winding that is opposite in polarity to the voltage pulse produced by the leading edge of the cut.

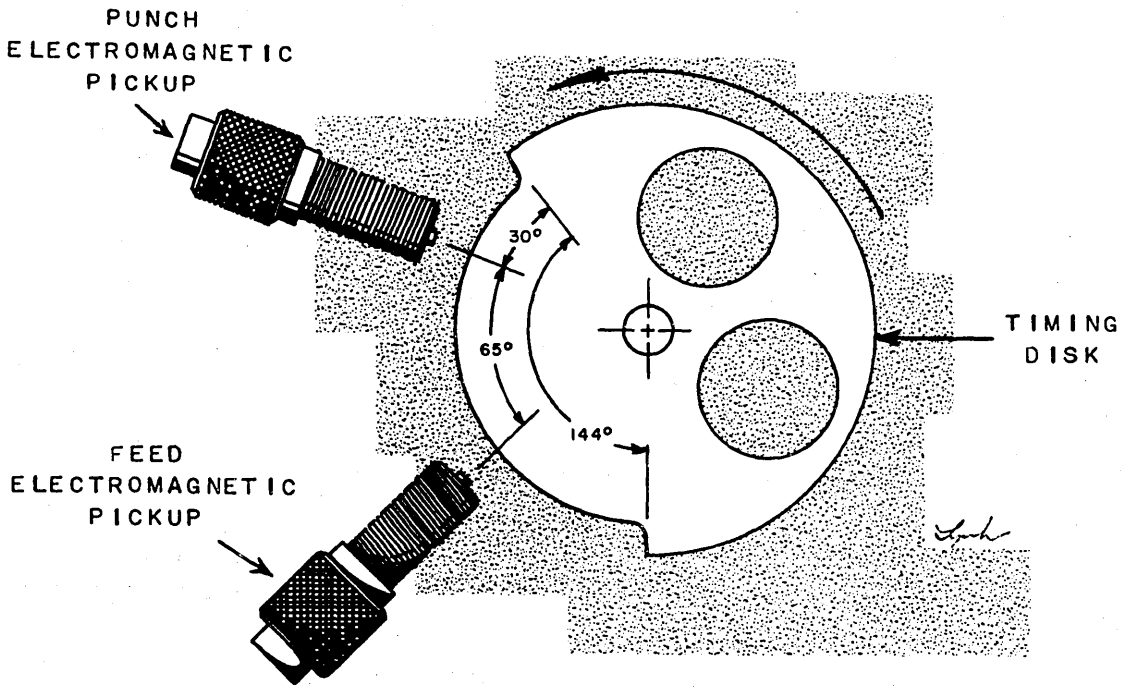


FIGURE 1-7. TIMING PULSE GENERATION.

The position of the timing disk with respect to the pickups, shown in Figure 1-7, occurs when the punch eccentric is at bottom dead center. This position is referred to as the 0^{o} position. The timing disk rotates in a counterclockwise direction at a speed of 120 rps, completing one revolution in 8.3 milliseconds and one degree of rotation in 23 microseconds. The trailing edge of the cut in the timing disk passes the punch electromagnetic pickup at 30^{o} (0.7 ms) and the feed electromagnetic pickup at 95^{o} (2.2 ms). The leading edge of the cut passes the punch electromagnetic pickup at 246^{o} (5.7 ms) and the feed electromagnetic pickup at 311^{o} (7.2 ms). Thus, during each revolution of the timing disk, the punch electromagnetic pickup produces two voltage pulses that are opposite in polarity, with the second pulse occurring 5 milliseconds after the first pulse. The feed electromagnetic pickup also produces two voltage pulses that are opposite in polarity, with the second pulse occurring 5 milliseconds after the first. Since a point on the rim of the timing disk passes the feed electromagnetic pickup 65^{o} after it passes the punch electromagnetic pickup, a pulse is produced by the feed electromagnetic pickup 1.5 milliseconds after a pulse is produced by the punch electromagnetic pickup.

Figure 1-8 shows the time relationship between the outputs of the electromagnetic pickups, the inputs required from an external control to the sprocket punch magnet and the feed magnet, and the motion of the punch pin and paper tape during a punch and feed operation. Whenever a hole is to be punched in a data channel, the external control delivers a pulse to the punch magnet that activates the punch mechanism in that channel. The data channel pulses are identical to and occur at the same time as the pulse delivered to the sprocket channel punch magnet.

1.2.2c Tape Punching. The Punch Head contains nine nearly identical tape

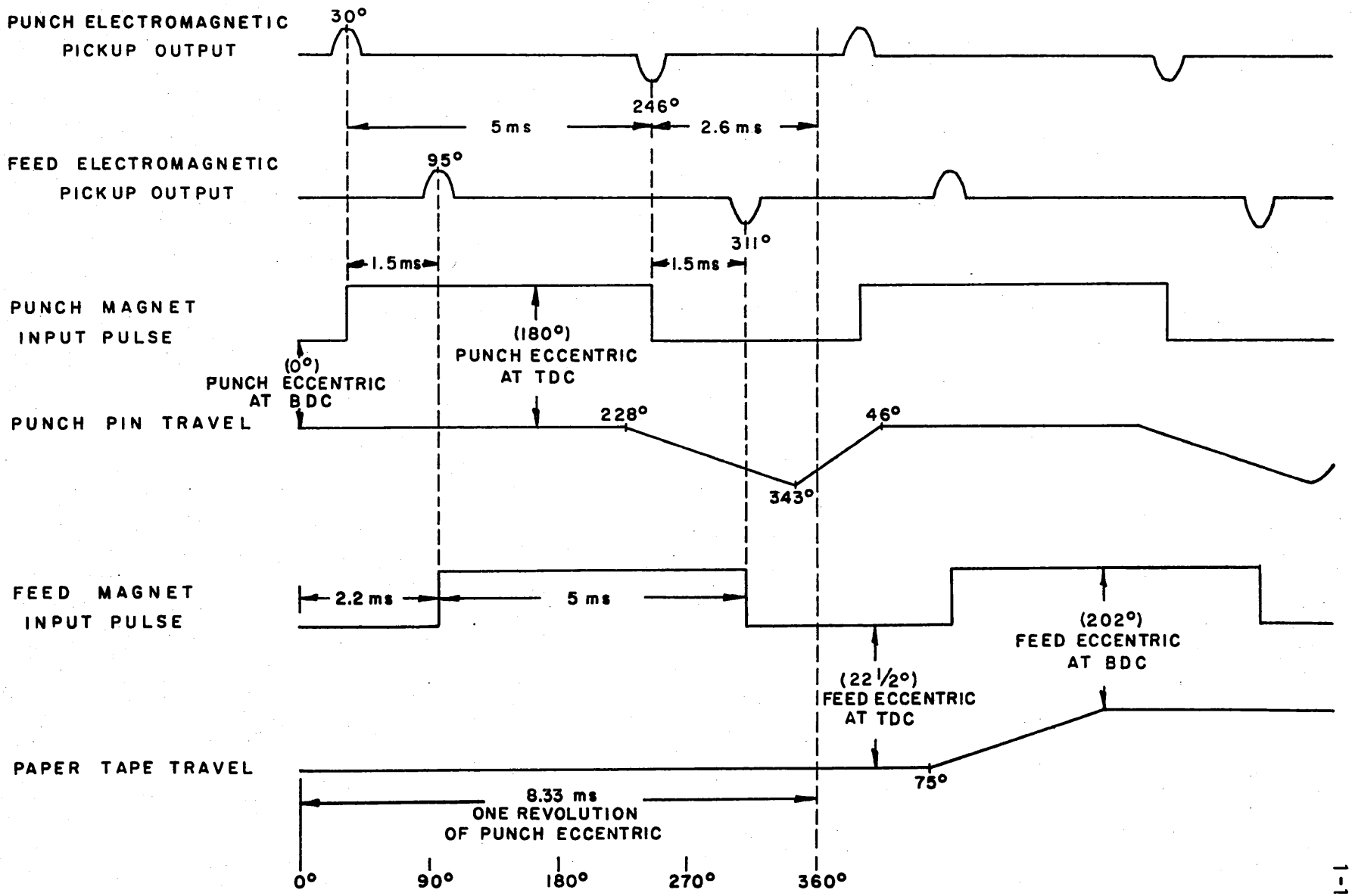


FIGURE 1-8. TIMING CHART.

punch mechanisms. Each tape punch mechanism punches a hole in paper tape when its associated punch magnet is energized by an external control at the proper time in the punch drive cycle. Eight of the punch mechanisms punch coded data in either 8, 7, or 5 channel codes. The ninth punch mechanism punches a feed sprocket hole every time a tape character is punched by the data punch mechanisms.

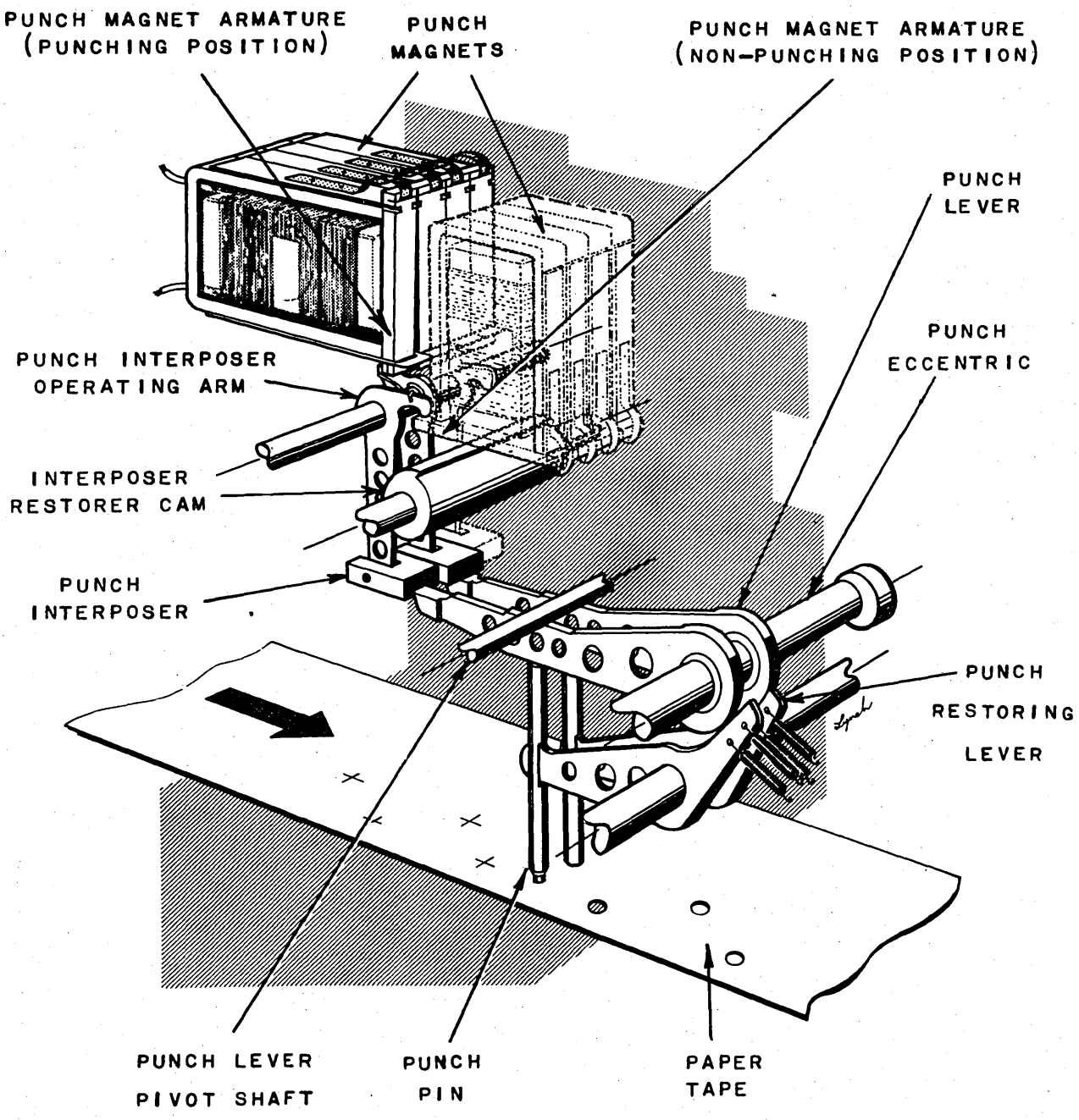


FIGURE 1-9. TAPE PUNCHING MECHANISMS.

Figure 1-9 shows two of the nine punch mechanisms. The punch magnet associated with the punch mechanism in the foreground is shown de-energized to illustrate a non-punching operation. The punch magnet for the punch mechanism in the back-

ground is shown energized to illustrate a punching operation.

The punch levers of the nine punch mechanisms are mounted side by side on the punch eccentric. Each punch lever is associated with a punch pin, punch lever restoring arm, punch interposer, punch interposer operating arm, and punch magnet. A punch lever comb and an interposer guide comb maintain proper alignment of the punch levers with the punch pins and the punch interposers. The punch pins are mounted side by side in the punch block and die assembly. Springs attached to each punch restoring lever cause the punch restoring levers to lift the punch pins out of the die block to hold the punch levers of the non-punching mechanisms against the punch lever pivot shaft.

Since the punch magnet in a non-punching channel is de-energized, the punch interposer arm spring forces the lower end of the punch interposer operating arm to the left. This moves the punch interposer away from the tip of the punch lever, as shown in Figure 1-9. As the punch eccentric rotates counterclockwise, the punch lever slides and pivots on the punch lever pivot shaft and the punch pin so that the tip of the punch lever traces a clockwise ellipse. When the punch eccentric is at top dead center, the tip of the punch lever will be at its lowest point, and when the punch eccentric is at bottom dead center, the tip of the punch lever will be at its highest point.

When a punch magnet is energized, the punch magnet armature is attracted to the punch magnet pole piece with sufficient force to overcome the tension of the punch interposer operating arm spring and the armature spring. The movement of the punch magnet armature causes the punch interposer operating arm to rotate a small amount on its shaft. This moves the punch interposer to the right. As the punch eccentric rotates counterclockwise from top dead center toward bottom dead center, the tip of the punch lever attempts to rotate clockwise from its lowest point to its highest point. When the punch eccentric reaches 48^{o} past top dead center, the tip of the punch lever is prevented from rising by the punch interposer. As the punch eccentric continues to rotate, the punch lever, acting as a power lever with the punch interposer for a fulcrum, forces the punch pin down through the paper tape and into the die block. When the punch eccentric reaches about 163^{o} past top dead center, the tip of the punch lever, which is now sliding to the right on the lower surface of the punch interposer, reaches the edge of the punch interposer. At this point, the springs attached to the punch lever restoring arm cause the punch pin to return the punch lever to a position against the punch lever pivot shaft. Since the punch magnet is now de-energized, the punch interposer arm spring returns the punch interposer to its non-punching position.

The punch lever restoring arms are mounted on an eccentric shaft so that the clearance between the cam surfaces of the punch levers and the punch lever restoring arms can be adjusted. The clearance is set to less than 0.0005 inch when the punch levers and the punch lever restoring arms are closest in a non-punching cycle. If a punch pin should stick in the die block during a punch cycle, the cam surface of the punch lever presses against the cam surface of the punch lever restoring arm. This releases the punch pin and restores the punch lever to a position against the punch lever pivot shaft.

If a punch interposer should stick in the punch position, the interposer restorer cam on the reset line presses against the punch interposer operating arm and restores the punch interposer to the non-punching position. The interposer is fully restored when the offset on the interposer restorer cam is fully against the interposer operating arm. This occurs when the punch eccentric is at $104\text{-}1/2^{o}$ past bot-

tom dead center. When the punch eccentric reaches 128° past bottom dead center, the offset on the interposer restorer cam is in a position that does not interfere with movement of the interposer operating arms. This allows those punch interposers associated with an energized punch magnet to move to their punch position.

1.2.2d Tape Feeding. At the end of each tape punching operation, the feed mechanism of the Punch Head advances paper tape 0.1 inch so that the paper tape is in the proper position for the next tape punching operation. To initiate a paper tape feed operation, the external control used with the Punch Head must deliver a 5 millisecond pulse to the feed magnet at the proper time in the mechanical cycle of the Punch Head. Proper timing of the feed magnet pulse is shown in Figure 1-8.

The tape feed machanism is driven by the feed eccentric on the punch eccentric line. Figure 1-10 shows the feed mechanism with the feed magnet energized and the

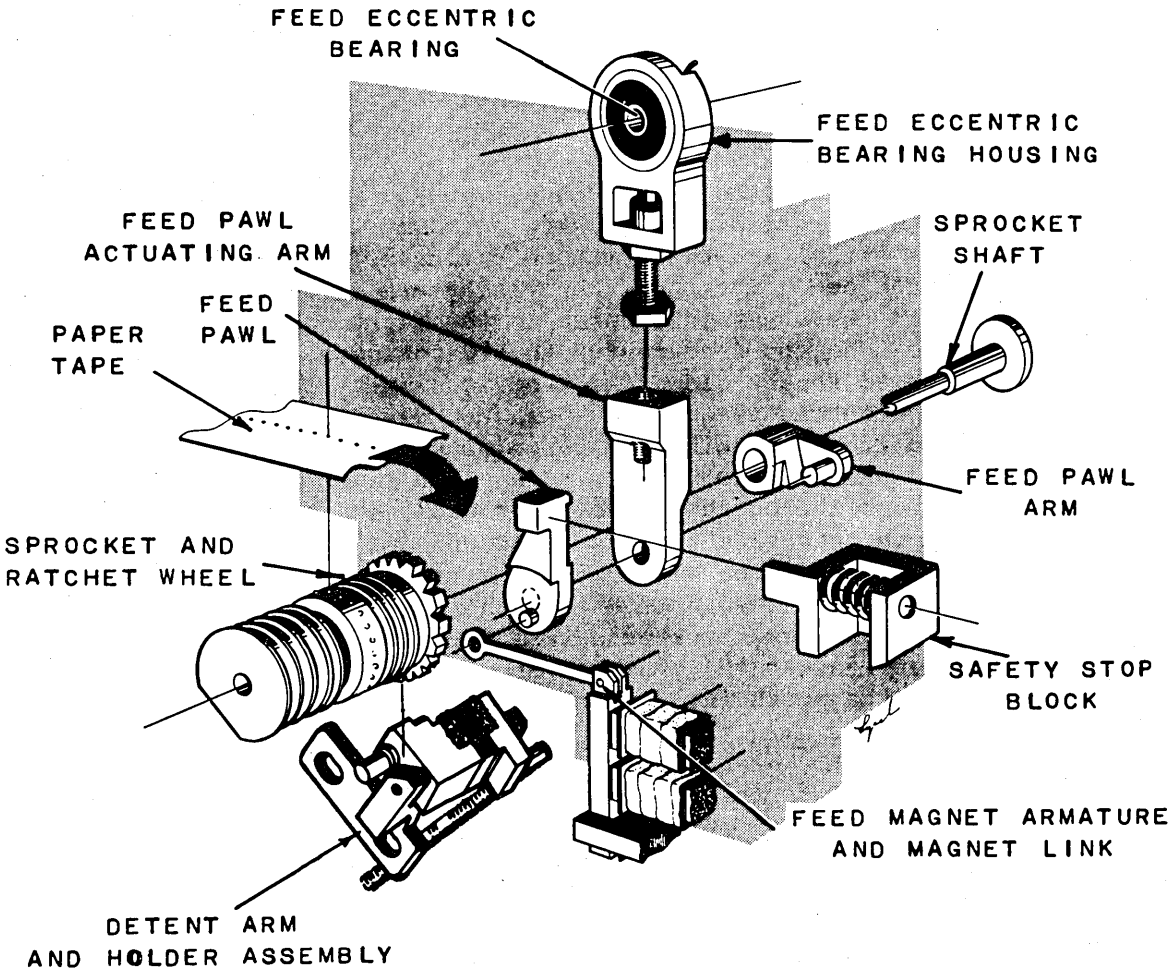


FIGURE 1-10. TAPE FEED MECHANISMS.

feed eccentric at top dead center. A stud on the feed pawl arm passes through the feed pawl actuating arm into a hole in the feed pawl. The feed pawl actuating arm is connected to the feed eccentric bearing housing. When the feed eccentric rotates, the feed pawl actuating arm moves up and down carrying the feed pawl with it. The

magnet link is attached to the feed magnet armature and a stud on the feed pawl. This stud is centered slightly below the hole that accepts the feed pawl arm stud. When the feed magnet is energized, the feed magnet armature is attracted to the feed magnet pole pieces. This causes the feed pawl to rotate counterclockwise on the feed pawl arm stud until it strikes the ratchet wheel of the sprocket and ratchet wheel. As the feed eccentric rotates from top dead center to bottom dead center, the feed pawl moves downward, engages a ratchet on the ratchet wheel, and rotates the sprocket and ratchet wheel clockwise one notch. A detent roller is held against the ratchet wheel under tension to insure that the ratchet wheel rotates an equal amount each time it is advanced by the feed pawl. Paper tape is held firmly against the sprocket and ratchet wheel by the tape guide shoe. Twelve feed pins on the sprocket and ratchet wheel engage the sprocket holes punched in the paper tape by the sprocket punch mechanism. Paper tape is advanced 0.1 inch each time the sprocket and ratchet wheel is advanced by the feed pawl.

When the feed magnet is de-energized, the feed magnet armature spring forces the armature away from the feed magnet pole pieces. This causes the feed pawl to rotate clockwise on the feed pawl arm stud until it strikes the spring plunger in the safety stop block. Now, as the feed eccentric rotates, the feed pawl slides up and down against the spring plunger and can not engage the ratchet wheel to advance paper tape.

1.2.2e Tape Break Detection. The tape break detector signals the external control used with the Punch Head to remove power and signal inputs to the Punch Head whenever tape breaks, the end of the tape passes through the paper tape guide, or tape is being loaded in the Punch Head. Figure 1-11 shows the position of the tape break detection elements with paper tape properly loaded in the Punch Head.

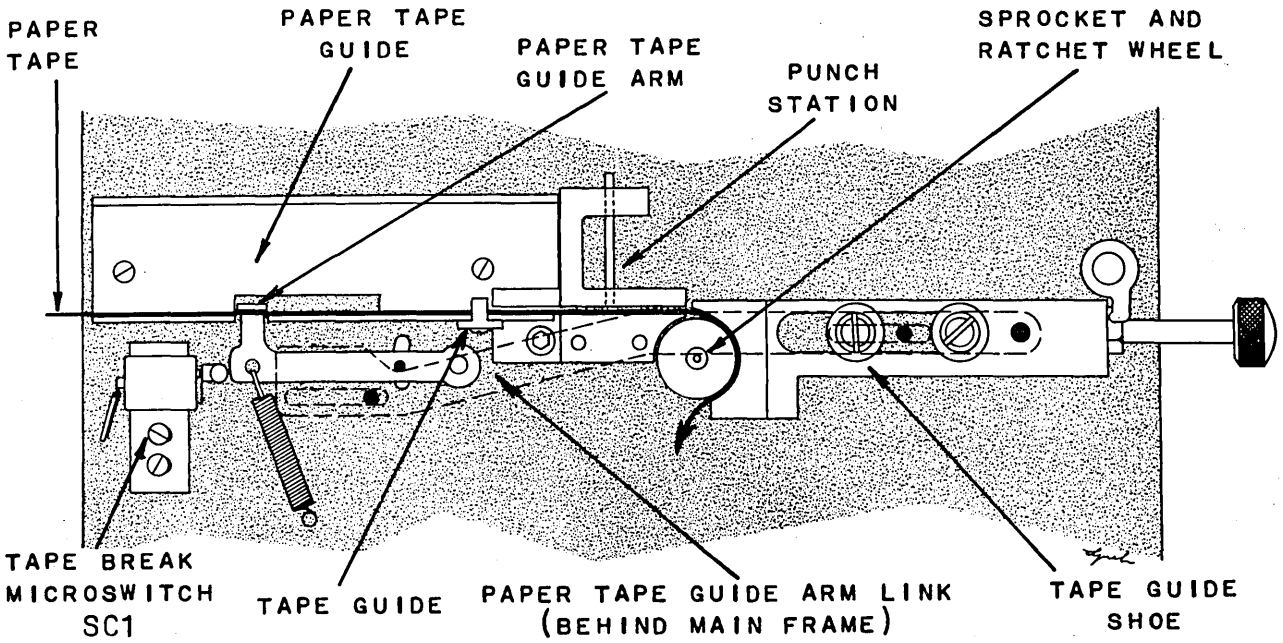


FIGURE 1-11. TAPE BREAK DETECTION.

With paper tape properly loaded, the paper tape guide arm is supported by the

paper tape as it passes through the paper tape guide. In this position, the protrusion on the paper tape guide arm presses against the tape break microswitch actuator, as shown in Figure 1-11, and actuates the microswitch. The external control may be wired to either the normally open or the normally closed contacts of the microswitch. In either case, the external control must be such that it applies power and signal inputs to the Punch Head only when the microswitch is actuated.

If paper tape breaks, when the end of the tape passes under the tape guide arm, the tape guide arm will be pulled downward by the guide arm spring. This releases the microswitch and the external control removes power from the punch head.

The tape break detector also functions when tape is being loaded in the Punch Head. To load tape, move the tape guide shoe away from the sprocket wheel. The tape guide shoe is connected to the tape guide arm link as shown in Figure 1-11. When the tape guide shoe is moved to the right, the paper tape guide arm link also moves to the right. When the guide arm link moves to the right, the incline on its far left end raises the paper tape guide arm. This releases the microswitch and the external control removes power from the Punch Head.

1.2.2f Punch and Feed Timing Summary. The operation of the Punch Head is such that punching will occur first, followed by a feed of the tape. With a constantly rotating eccentric shaft, a starting point must arbitrarily be selected. In this case 0^{o} will be located at bottom dead center of the punch eccentric. The shaft turns counterclockwise viewed from the front and it will be in this direction that the degrees are figured. The punch cycle time is 8.33 milliseconds, the time required to complete 360^{o} of rotation.

The Punch Head has two reluctance heads known as electromagnetic pickup heads. The reluctance heads are so mounted that a pulse is generated in the punch reluctance head 65^{o} ahead of the pulse generated in the feed reluctance head. Pulses will occur again 216^{o} later in each of the heads in opposite polarity to the first ones. The polarity of the first pulse in each head may be either plus or minus depending on how the leads to the head are wired into the circuit using this pulse. The second pulse in each head will always be in the opposite direction. Figure 2-8 shows an actual measurement of a reluctance head output. This measurement should not be considered optimum since the output of the reluctance heads can vary from 7 to 27 volts.

In the following examples it will be assumed that the leading edge of the timing disc is generating a positive pulse in both reluctance heads. The four types of examples given are:

1. First punching cycle.
2. Second punch cycle and subsequent punchings.
3. Non-punching cycle following a punch cycle.
4. Non-punching cycle following a non-punch cycle.

The movements of the Punch will begin at 0^{o} or punch eccentric bottom dead center. Figure 1-12 illustrates the punch and feed timing sequence.

First Punching Cycle

30^{o} Positive punch magnet reluctance head pulse is generated.
75^{o} Feed pawl passes ratchet tooth, no feed as feed magnet is not energized.
95^{o} Positive feed magnet reluctance head pulse is generated.

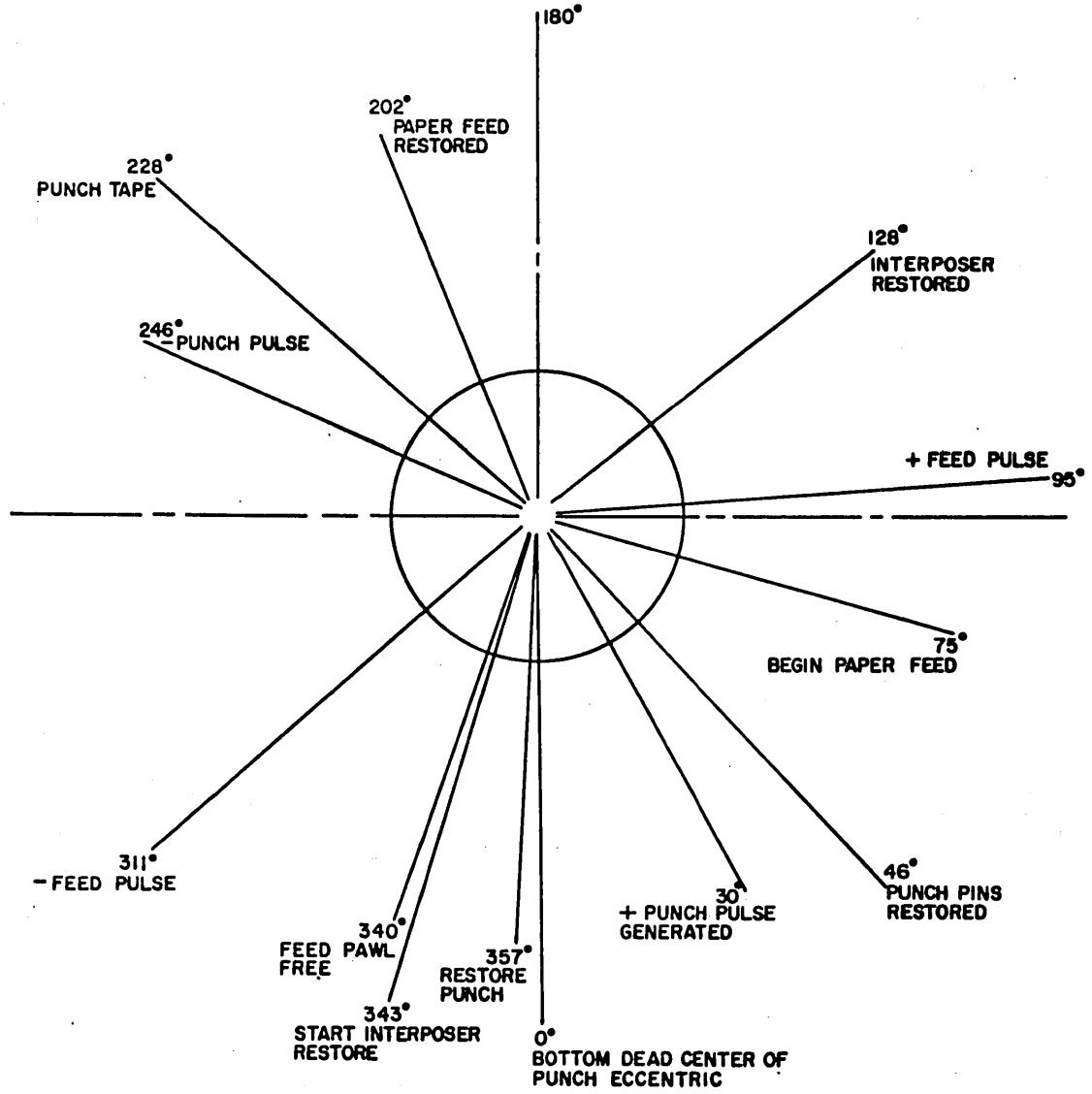


FIGURE 1-12. TIMING LAYOUT.

128° Interposers are free to be pulled in by punch magnets.
202° Tape feed mechanism moves up to restore.
228° Punch first character in tape.
246° Negative punch magnet reluctance head pulse is generated.
311° Negative feed magnet reluctance head pulse is generated.
340° Feed pawl is now free to be pulled in.
343° Begin to restore the interposers.
357° Start restoring punch pins.

Subsequent Punchings

30° Positive punch magnet reluctance head pulse is generated.
46° Punch pins are restored.

75° Feed pawl is engaged and paper feed begins.
95° Positive feed magnet reluctance head pulse is generated.
128° Interposers are freed to be pulled by the punch magnets.
202° Paper feed completed.
228° Paper tape is punched.
246° Negative punch magnet pulse is generated.
311° Negative feed magnet pulse is generated.
340° Feed magnet is free to be pulled in.
343° Interposers begin to restore.
357° Punch pins begin to restore.

Non-Punching Following a Punch Cycle

30° Positive punch magnet pulse is generated.
46° Punch pins restored.
75° Feed pawl is engaged, and begins tape feed.
95° Positive feed magnet pulse is generated.
128° Interposers are free to be pulled by punch magnet except that none are selected.
202° Paper feed completed.
246° Negative punch magnet pulse is generated.
311° Negative feed magnet pulse is generated.

Non-Punching After a Non-Punch Cycle

30° Positive punch magnet pulse is generated.
95° Positive feed magnet pulse is generated.
246° Negative punch magnet pulse is generated.
311° Negative feed magnet pulse is generated.

1.3 ELECTRICAL DESCRIPTION

The Tape Punch contains a minimum of electrical circuits. All amplifier, control logic, punch magnet driver, feed magnet driver, and power supply circuits must be provided by external associated equipment. The following paragraphs provide an explanation of the Tape Transport and Punch Head Circuits. There are no internal electrical connections between the Tape Transport and Punch Head.

1.3.1 Tape Transport. Figure 1-13 is a schematic of the Tape Transport circuits. Supply motor M302 is controlled by the operation of microswitch SC305 which is actuated when the tape supply loop is shortened. With SC305 actuated, relay K301 is energized by the externally applied 24 volts. Contacts 22-23 of relay K301 close when the relay is energized and contacts 21-22 open. This disconnects the 8v DC used for braking and applies 115v power to the supply motor. The 8v DC is obtained from the half-wave rectifier circuit consisting of CR312, R301, R302, and C301. The series RC circuit across contacts 22-23 of relay K301 is a spark suppressor designed to prevent damage to the contacts from electrical arcing. Diode CR317 is a damping diode.

The tape brake on the take-up side of the tape transport is controlled by the operation of microswitch SC304 which is actuated when the take-up loop is shortened. With SC304 actuated, current from the external 24 volt source flows through tape brake solenoid L301. The brake shoe is then attracted to the solenoid with suffi-

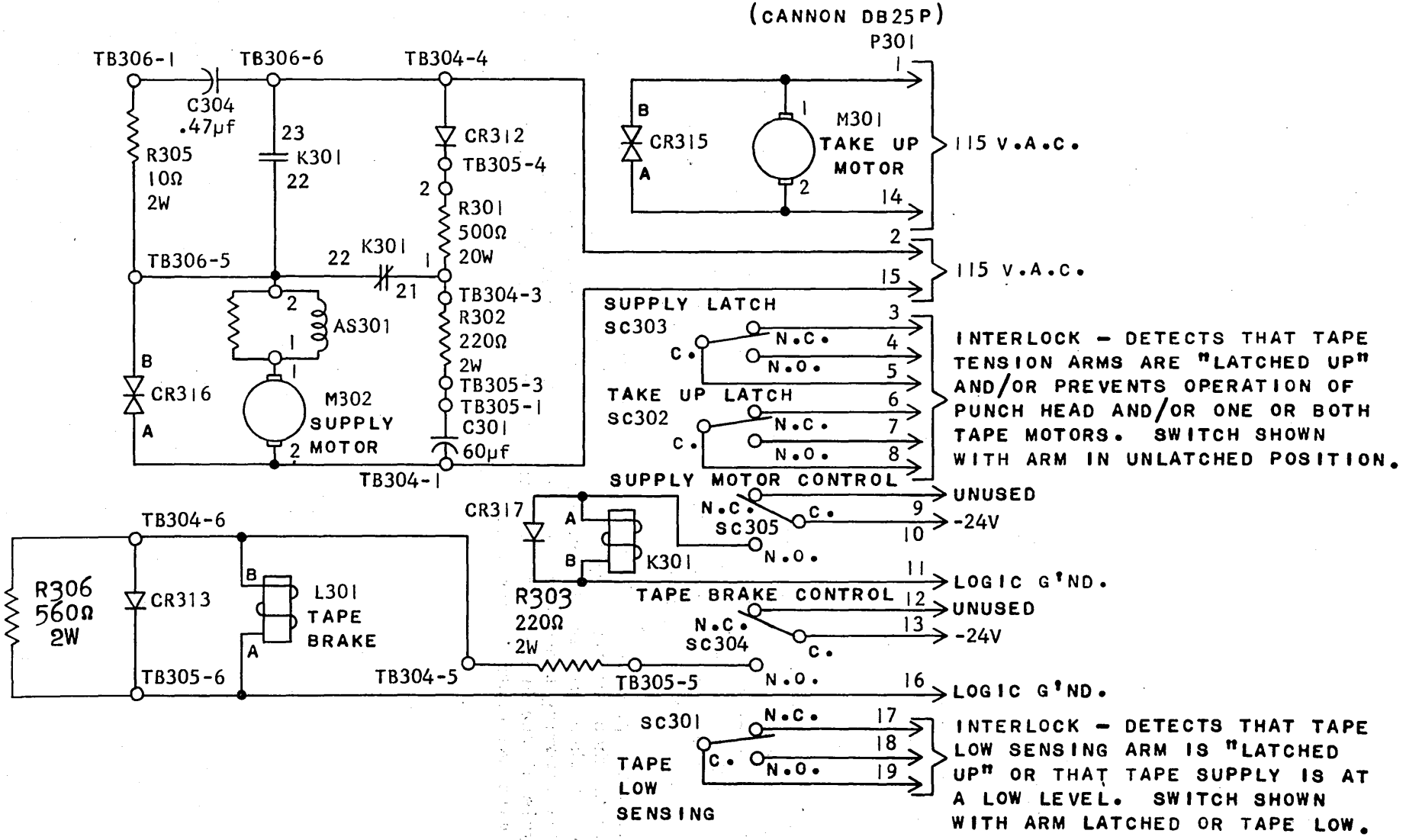


FIGURE 1-13. TAPE TRANSPORT, SCHEMATIC.

cient force to prevent the tape from being pulled through the brake by the take-up motor M301. Diode CR313 and resistor R306 form a damping circuit for L301. Microswitches SC302 and SC303 provide indications to the external circuits that the take-up control arm and supply control arm are latched. Microswitch SC301 is actuated by the tape low sensing arm. When the tape supply is nearly gone, SC301 is released and indicates the low tape situation to the external circuits.

1.3.2 Punch Head. Figure 1-14 is a schematic of the Punch Head Circuits. The drive motor starting circuit consists of thermal circuit breaker SP1, starting capacitor C1, and motor starting relay K1. The coil of start relay K1 and the heater and bimetal contacts of thermal circuit breaker SP1 are connected in series with the main winding of the drive motor as shown in Figure 1-14. When 115 volts is initially applied to the Punch Head, approximately 7 amperes flows through thermal circuit breaker SP1, the main winding of the drive motor, and the coil of start relay K1 causing K1 to energize. The normally open contacts of K1 close and connect capacitor C1 and the start winding of the drive motor across the main winding of the drive motor. As the rotor of the drive motor accelerates, motor current decreases. When motor current drops to about 5.7 amperes, K1 de-energizes. This disconnects C1 and the start winding from the circuit. The rotor continues to accelerate and motor current decreases still further. At synchronous speed (3600 RPM) the motor current is about 1.6 amperes.

Thermal circuit breaker SP1 protects the drive motor from damage due to current overload or high temperature operation. If the drive motor draws excessive current or operates at temperatures above 70°C (140°F) for extended periods, the bimetal contacts of SP1 open and remove 115 volts from the drive motor. Once opened, the bimetal contacts of SP1 remain open. In order to close the bimetal contacts, the reset button on SP1 must be pressed.

Microswitch SC1 provides either an open or short circuited indication to the external circuits when the tape input to the Punch Head breaks. The punch and feed electromagnetic pickups provide timing signals to the external control circuits to insure that the incoming punch and feed magnet pulses are synchronized with the mechanical cycle of the Punch Head. The nine punch magnets and one feed magnet are energized by external control circuits.

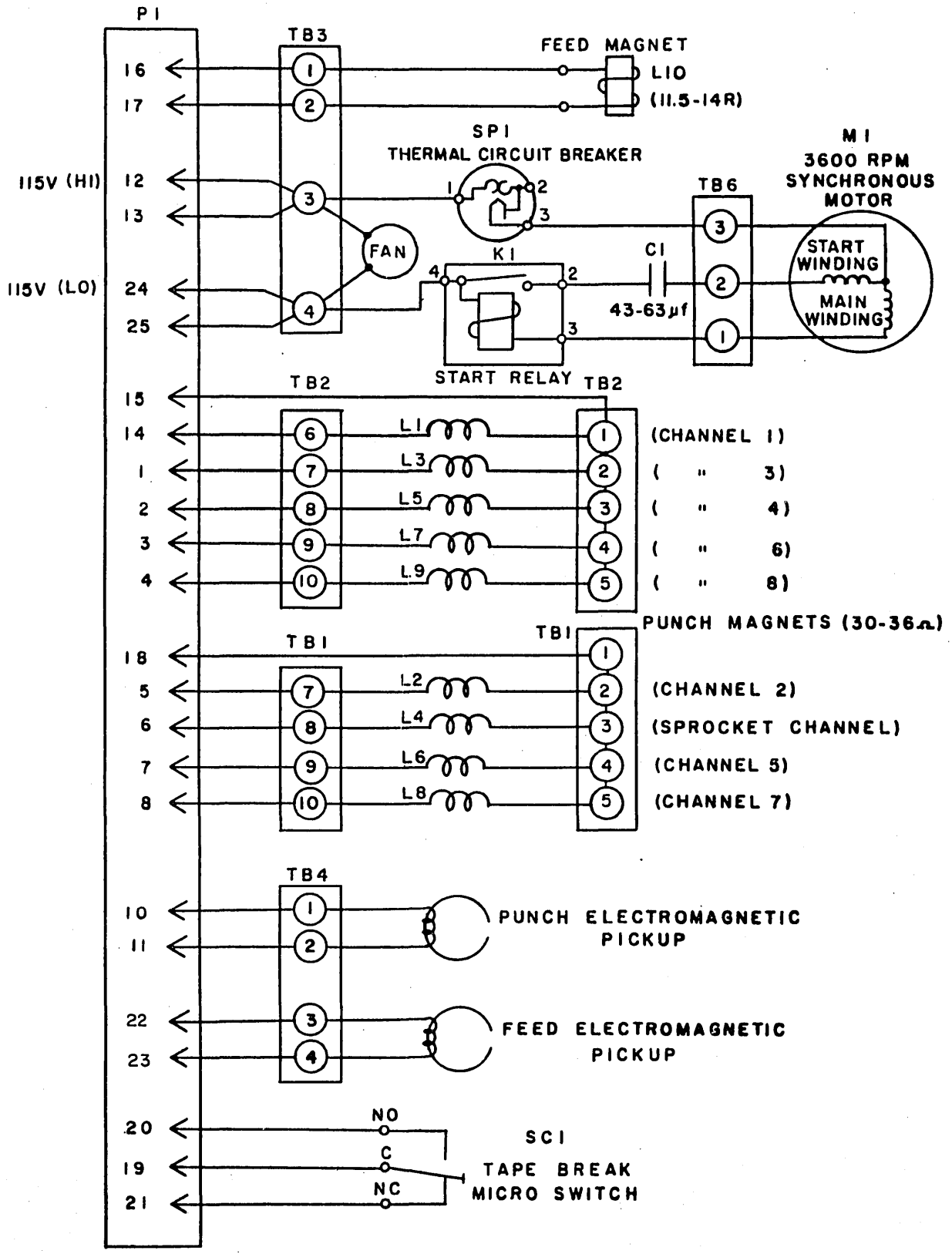


FIGURE 1-14. PUNCH HEAD, SCHEMATIC.

SECTION 2. EQUIPMENT SPECIFICATIONS

2.0 INTRODUCTION

This section presents the physical characteristics, input and output characteristics, and operational specifications for the NCR EM-B2 Paper Tape Punch.

2.1 PHYSICAL CHARACTERISTICS

The Tape Punch is 26-5/32 inches high, 19 inches wide, and 11-3/8 inches deep. See Figure 2-1. The total weight of the Tape Punch is 72.5 pounds. The tape Transport weighs 40.5 pounds and the EM-B1 Punch Head weighs 32 pounds. Mounting of the Punch Head to the Tape Transport panel is accomplished by five mounting screws as shown in Figure 2-1. Rubber shock mounts are used to isolate the mechanical vibration of the Punch Head from the Tape Transport and parent unit. Provision for mounting the Tape Transport to the parent unit is provided by 12 tapped mounting holes located on the Tape Transport frame, as shown in Figure 2-1. The tape Punch is intended for operation in a vertical position.

Electrical connections to the Tape Punch are made through two Cannon DB25P connectors. The nomenclature for the required mating connectors is Cannon DB25S. Connector P301, located at the lower right rear corner of the Tape Transport panel, provides connections for the Tape Transport circuits. Connector P1, located in the upper right rear corner of the Punch Head, provides connections for the Punch Head circuits.

Figures 2-2, 2-3, 2-4, 2-5, and 2-6 in conjunction with Figure 1-3 illustrate the physical location of the major components of the Tape Punch.

2.2 INPUT AND OUTPUT CHARACTERISTICS

The electrical inputs to the Tape Punch must be supplied by a controlled external source. The inputs consist of AC operating power for the motors, DC operating power for relay K301 and the tape brake, and punch and feed magnet driving pulses. The outputs consists of punch and feed timing signals, low-tape indication, supply and control arm latch indications, and tape break indication.

2.2.1 Input Characteristics. Inputs in accordance with the following specifications are required for proper operation of the Tape Punch.

2.2.1a Tape Transport. Reference should be made to Figure 1-13 to determine the proper pin numbers of connector P301.

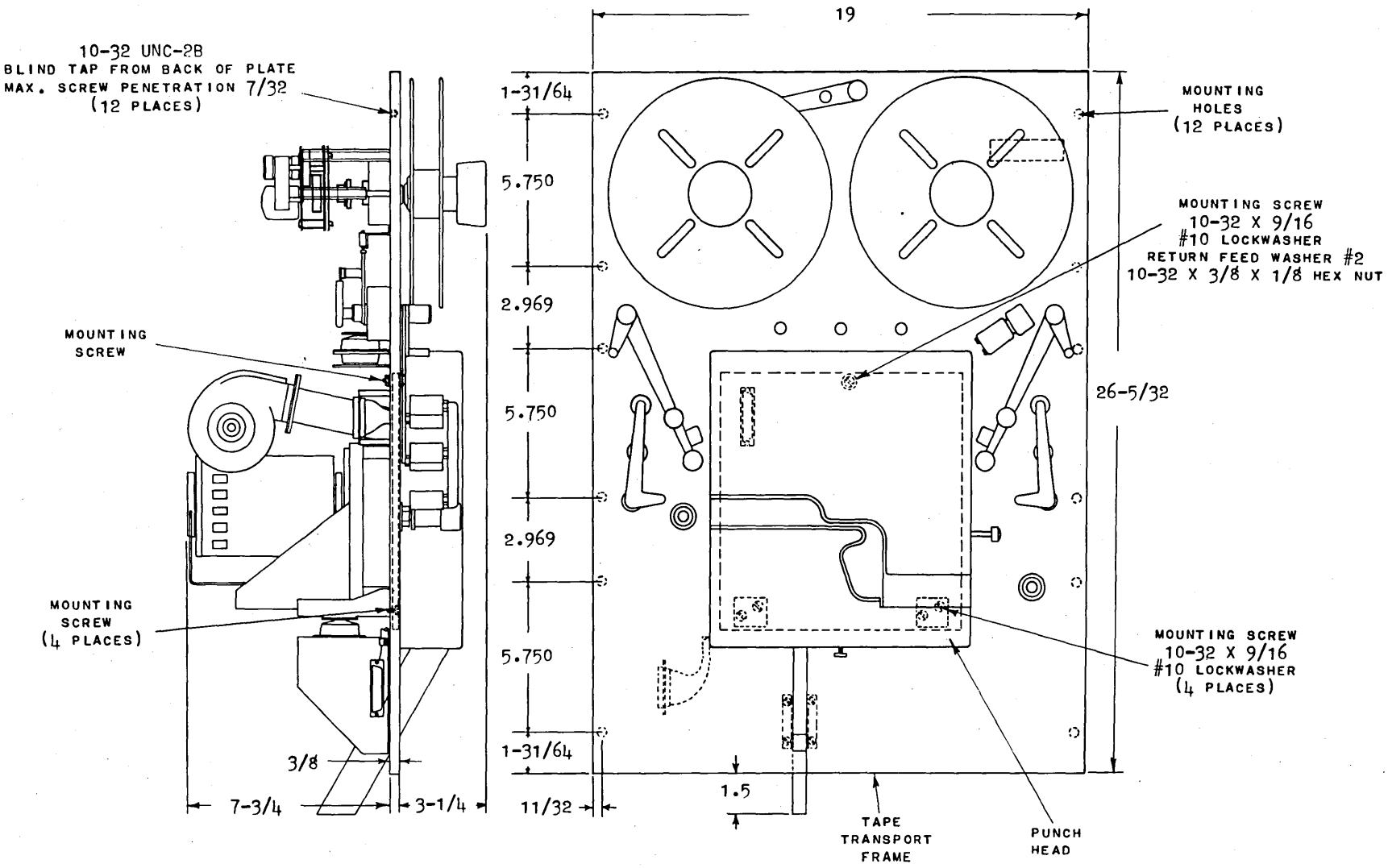


FIGURE 2-1. TAPE PUNCH, INSTALLATION DRAWING.

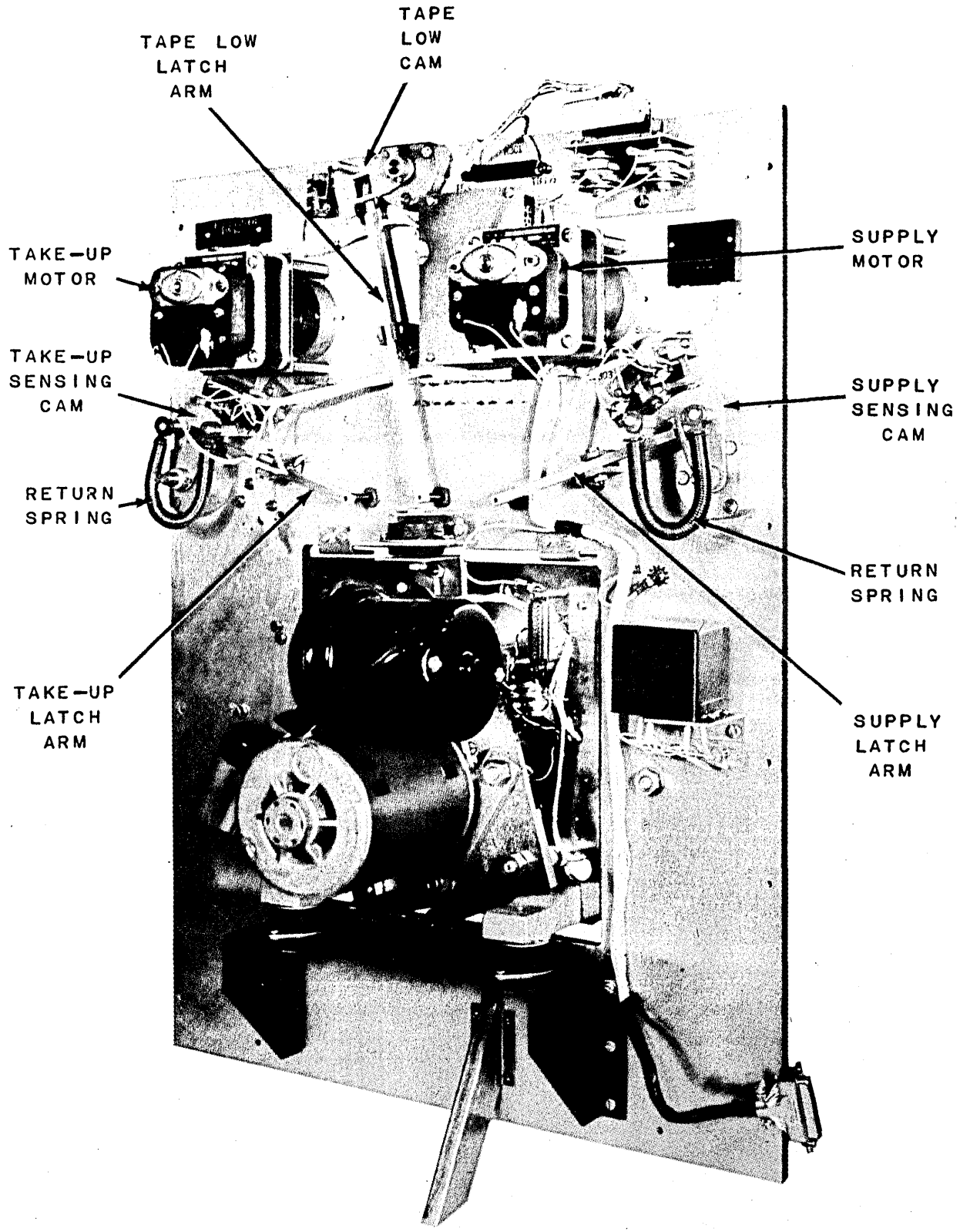


FIGURE 2-2. TAPE PUNCH, RIGHT REAR VIEW.

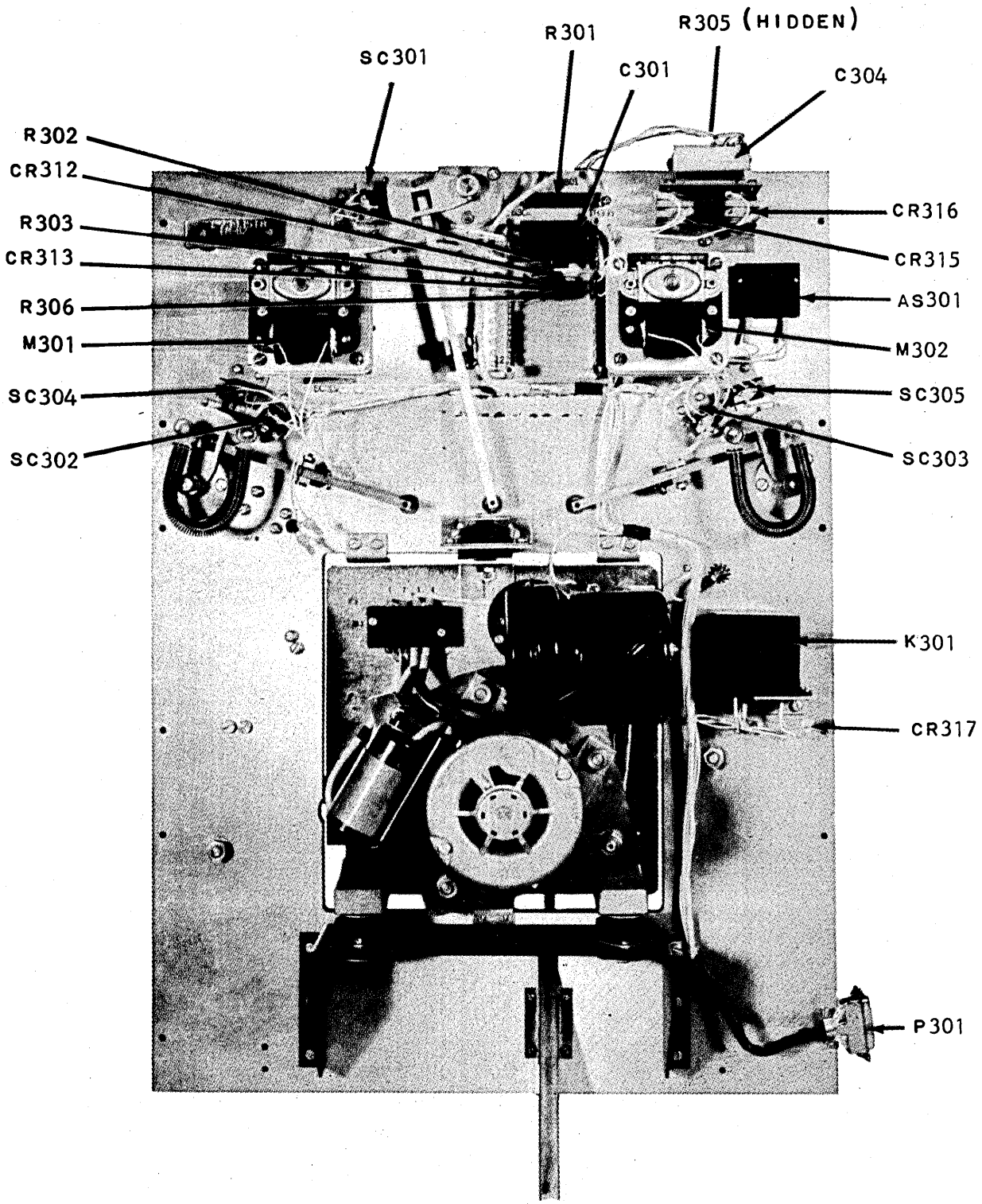


FIGURE 2-3. TAPE PUNCH, REAR VIEW.

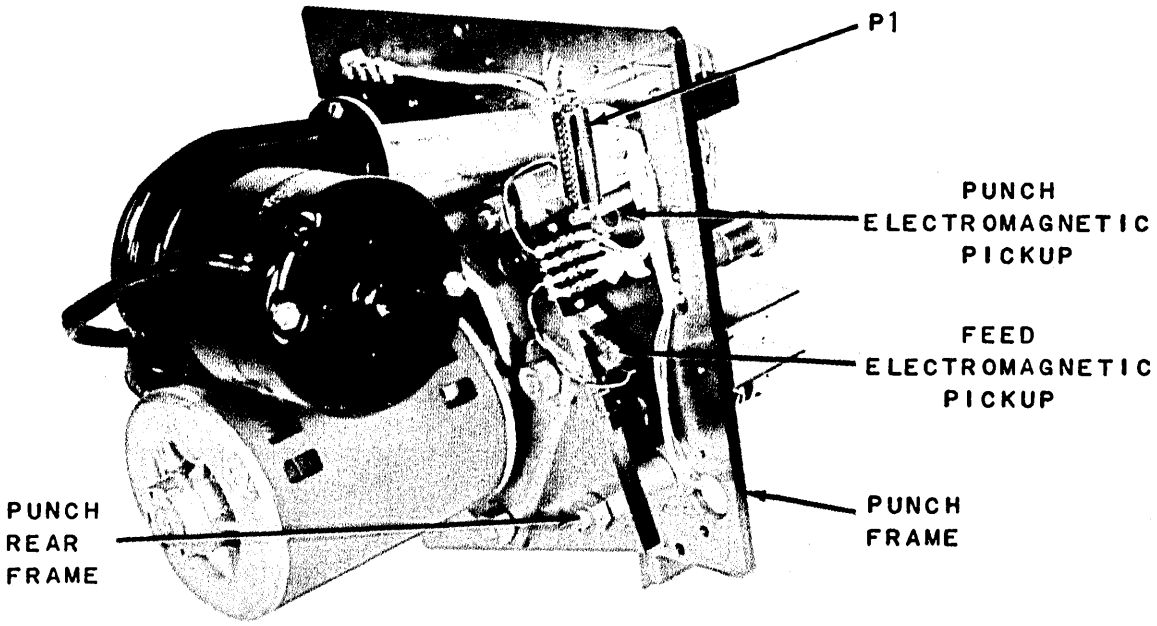


FIGURE 2-4. PUNCH HEAD, RIGHT REAR VIEW.

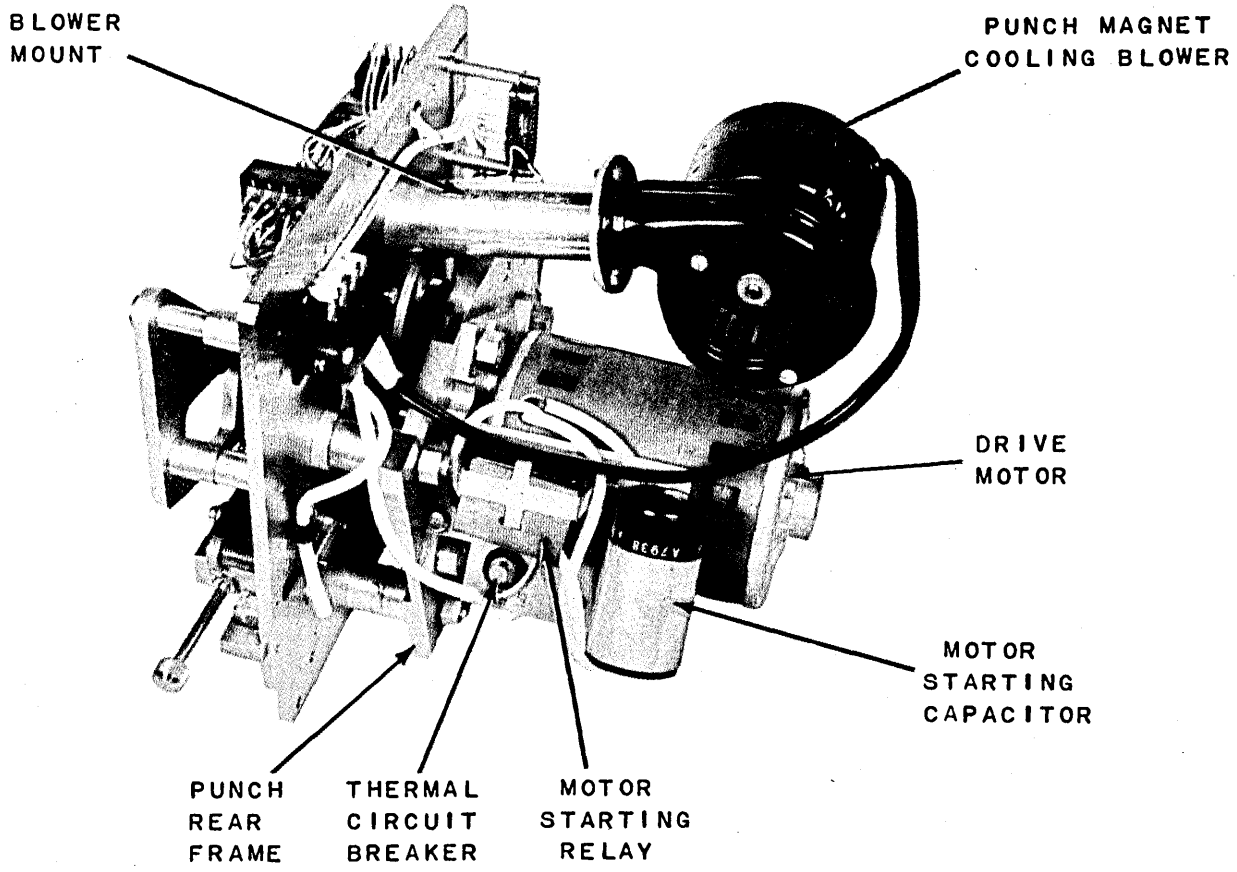


FIGURE 2-5. PUNCH HEAD, LEFT REAR VIEW.

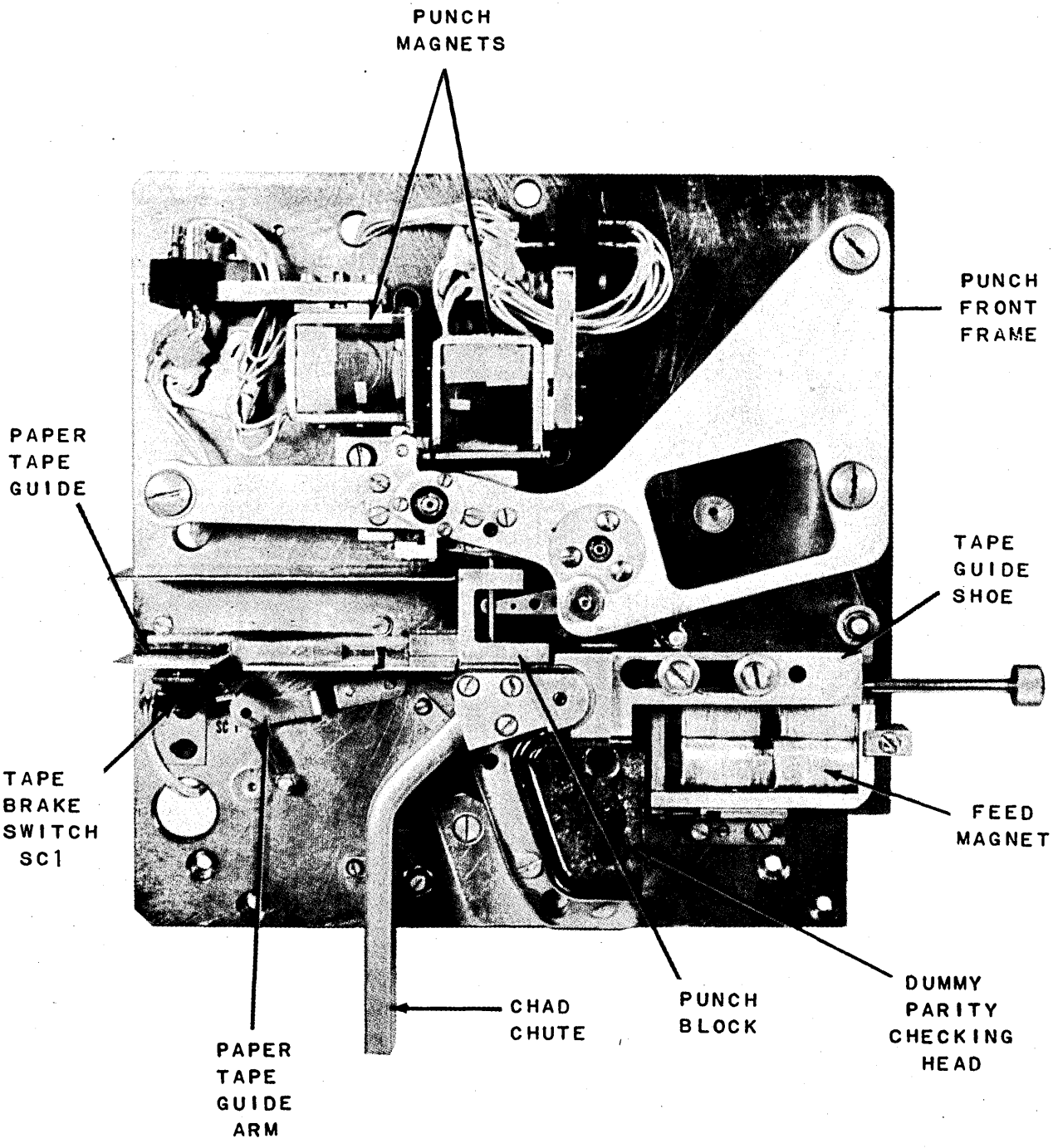


FIGURE 2-6. PUNCH HEAD, FRONT VIEW.

AC Power

Voltage: 117 ±10 volts
Frequency: 60 ±1 CPS (Transport Part Number 371X1639 or 371X1695)
50 ±1 CPS (Transport Part Number 371X1638 or 371X1696)
Current: 0.34 amperes

DC Power

Voltage: -24 ±2 volts
Current: 125 milliamperes

2.2.1b Punch Head. Reference should be made to Figure 1-14 to determine the proper pin numbers of connector P1.

AC Power

Voltage: 117 ±10 volts
Frequency: 60 ±1 CPS (EM-B1 Punch Head Part Number 371X800)
50 ±1 CPS (EM-B1 Punch Head Part Number 371X900)
Current: 7.1 amperes (starting)
1.6 amperes (running)

Punch Magnet Input Pulse

Peak Voltage: -24 ±2 volts
Peak Current: 0.6 to 0.87 amperes
Pulse Duration: 5 milliseconds, decaying to zero after turn off within the current wave shape of Figure 2-7.
Pulse Period: 8.33 milliseconds (continuous operation)

Feed Magnet Input Pulse

Peak Voltage: -24 ±2 volts
Peak Current: 1.6 to 2.3 amperes
Pulse Duration: 5 milliseconds, decaying to zero after turn off within the current wave shape of Figure 2-7.
Pulse Period: 8.33 milliseconds (continuous operation)

2.2.2 Output Characteristics. When operating properly, the Tape Punch will furnish the following output signals.

2.2.2a Tape Transport. Reference should be made to Figure 1-13 to determine the proper pin numbers of connector P301.

Tape Low

Microswitch SC301 closes when tape supply is low.

Supply Latch

Microswitch SC303 closes when supply control arm is latched.

Take-up Latch

Microswitch SC302 closes when take-up control arm is latched.

2.2.2b Punch Head. Reference should be made to Figure 1-14 to determine the proper pin numbers of connector P1.

Punch and Feed Timing Signals

Peak Voltage: 7 to 27 volts
Pulse Duration: 350 microseconds
Pulse Period: One cycle = 8.3 milliseconds.
One cycle consists of a positive pulse followed 5 milliseconds later by a negative pulse.

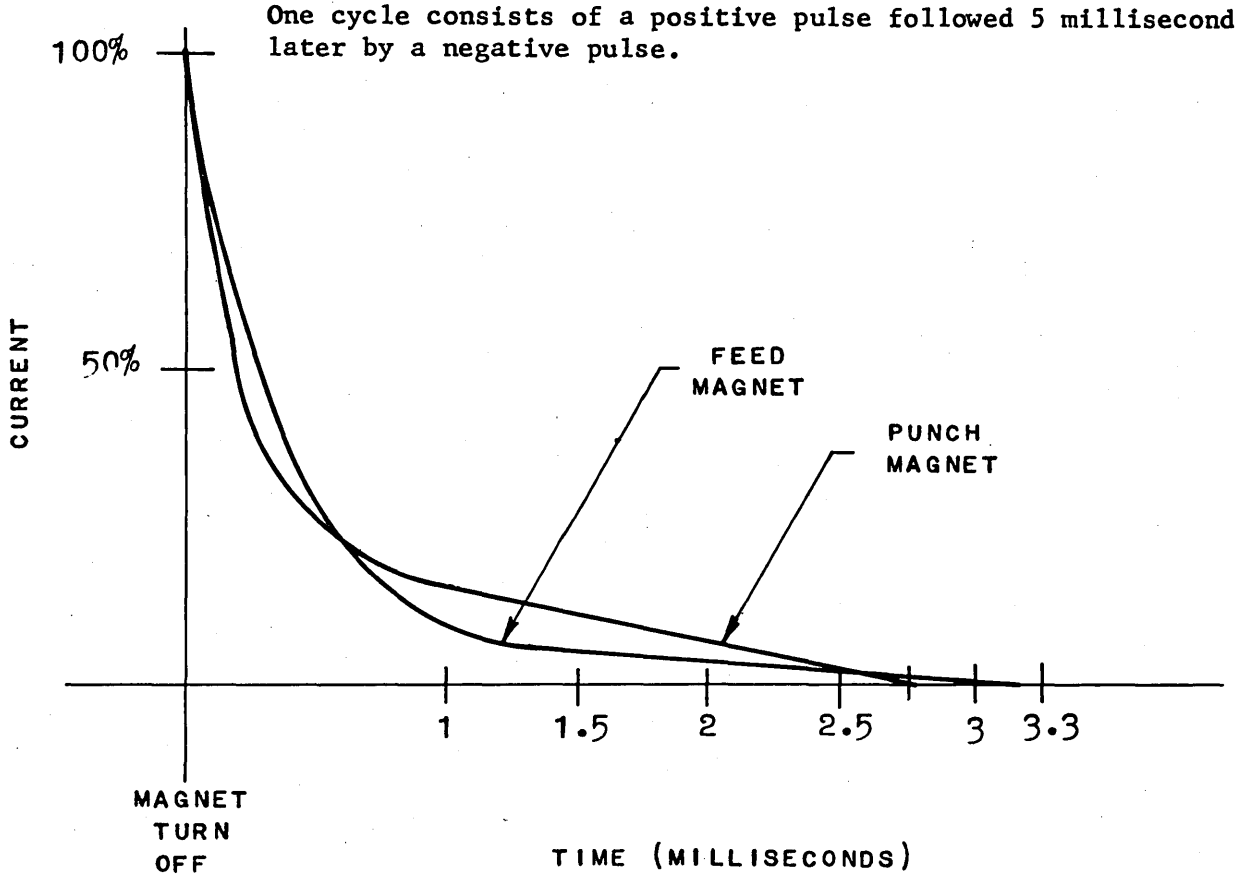


FIGURE 2-7. PUNCH AND FEED MAGNET TURN OFF CURRENT.

NOTE

The outputs of the electromagnetic pickups vary with the load and the clearance between the pickup and timing disc. Figure 2-8 illustrates a typical output from an electromagnetic pickup head with a 0.004 inch gap and 10K load.

Tape Break

Microswitch SC1 opens when tape breaks.

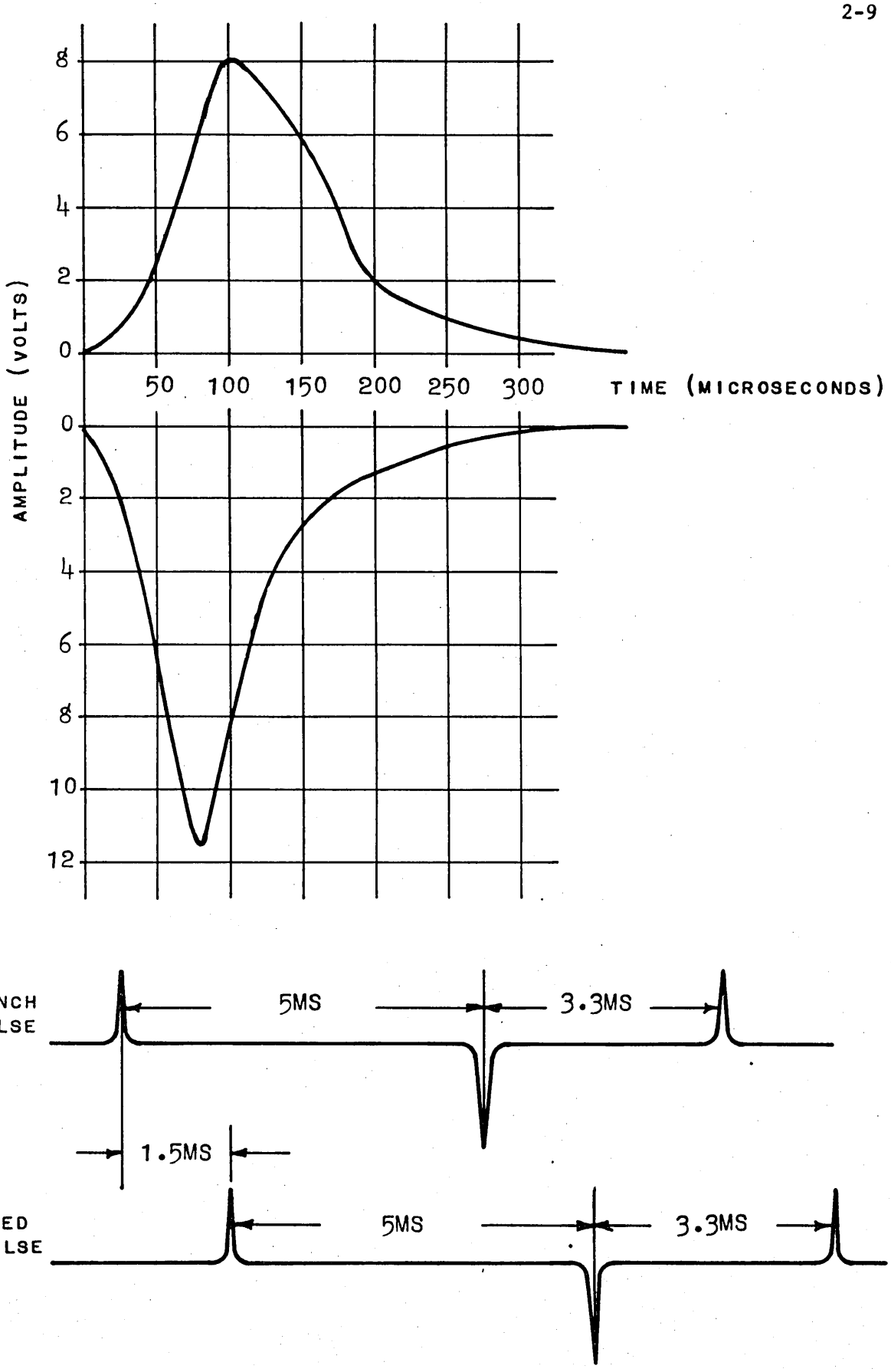


FIGURE 2-8. TYPICAL ELECTROMAGNETIC PICKUP OUTPUT.

2.3 OPERATIONAL SPECIFICATIONS

The following paragraphs describe the operation specifications of the Tape Punch.

2.3.1 Tape Tension. When using the EM-B1 Punch Head with a tape transport other than the one described in this manual, the maximum peak input and output tape tensions must not exceed one pound.

2.3.2 Punching Rates. The Tape Punch will punch paper tape at the rate of 120 ±2 characters per second, depending on line frequency. See paragraph 2.2.1a for frequency tolerance.

2.3.3 Reliability. If preventive maintenance is performed as directed in paragraph 4.1, there is no serious wear to the punch mechanism as a consequence of extended periods of "on time" without punching. The maximum allowable punch cycles for all punch magnets, not including the sprocket magnet, over an extended period of time (over 3 minutes) is 50 percent. This is a rate which would permit punching one-half of all the holes possible in a one inch wide length of tape. The sprocket punch magnet can be cycled continuously. The punching mechanism itself will permit continual (120 cps rate) punching of any or all channels for a 3 minute interval of time provided the overall limitation described above is followed. This does not infer that the punch cannot punch four rows of holes continuously.

The useful life of the Punch Head is a minimum of five years or 2,500 rolls of tape punched, whichever occurs first, provided that the preventive maintenance instructions in paragraph 4.1 are followed.

2.3.4 Environmental Limitations. The Tape Punch will withstand the following environmental conditions.

Operating	Minimum	Maximum
Temperature	68°F	90°F
Relative Humidity	40%	60%
Not Operating	**Minimum**	**Maximum**
Temperature	-40°F	180°F

Cycling may be at 60°F per hour or at a rate that will not permit condensation to occur.

All connectors, exposed contacts, and conductors are protected from normal corrosive atmospheres encountered along sea coasts and in industrial areas.

2.3.5 Vibration. When crated and ready for shipment, the two units of the Tape Punch are capable of withstanding the following vibration with no detrimental effects to operation or life expectancy.

A.	Frequency	10 to 55 cps
B.	Force	4g's or 0.018" half amplitude, whichever is smaller
C.	Time	2 hours

When reassembling the punch drive motor gear, set the timing and backlash per paragraph 4.2.2j.

If the Tape Punch is to be reshipped, the Punch Head should be shipped with the punch drive motor gear disengaged.

2.3.6 Media. The following paragraphs describe the standards for paper tape.

2.3.6a NCR Standards. The Tape Punch punches all types of NCR supplied and recommended tapes meeting the physical requirements of NCR's Purchasing Specification No. 7502.11 and Engineering Standard No. 5031.00.

The Tape Punch punches paper tape in conformance with Engineering Standard No. 5031.00 and NCR Drawing 97A21377.

Copies of these standards are located at the end of this section.

2.3.6b Tape Width. The Tape Punch punches 1 inch, 7/8 inch, and 11/16 inch wide paper tape (8, 7, and 5 channel tape respectively). The change over from one tape size to another is accomplished with minimum effort by the operator.

2.3.6c Tape Length. The Tape Punch is able to punch any length of tape from one foot up to the standard 8 inch diameter rolls of tape.

A standard NCR tape center core or equivalent must be used on the take-up reel to spool punched paper tape.

Core	Part Number
1 inch core	370B133
7/8 inch core	370B186
11/16 inch core	370B187

Reg. U. S. Pat. Off.

The National Cash Register Company

DAYTON, OHIO

SUBJECT: PERFORATED TAPE STANDARD.		ENGINEERING STANDARD NO. 5031.00
CHANGE NO.	APPROVAL DATE 5-9-62	NO. PAGES 2

A - General.

1. The following specifications for Perforated Paper Tape standard for NCR machines that punch and/or read paper tape.
2. Base paper for Perforator Tape shall be in accordance with P.S. 7502.11.
3. Engineering Reference.
   a. Paper Tape Standard 97A21377.
   b. Paper Tape Gauge 461C10111. (Tool Drawing, not listed)

B - Tape Dimensions.

1. Thickness shall be .004 $\pm$ .0003 per P.S. 7502.11.
2. Widths shall be measured at 73°F $\pm$ 2.5°F. and at 50% RH $\pm$ 2% RH.
   a. Tape widths.
      1. .686 $\pm$ .003
      2. .875 $\pm$ .003
      3. 1.000 $\pm$ .003

C - Tape Perforations. (All round holes)

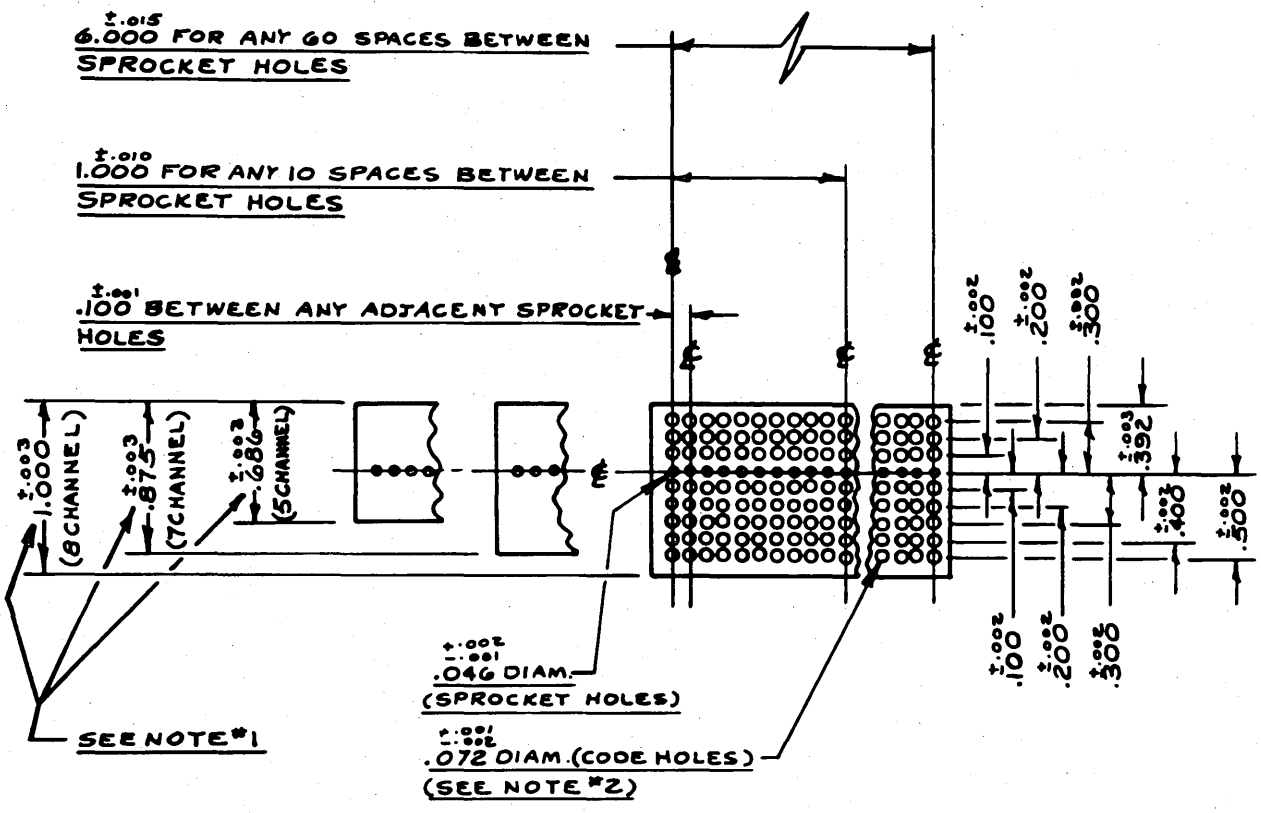
1. Sprocket Hole diameter and location.
   a. .046 $^{+.002}_{-.001}$ diameter of sprocket hole.
   b. .392 $\pm$ .003 from center of sprocket hole to edge of tape.
   c. .100 $\pm$ .001 longitudinal center to center distance to adjacent sprocket hole.
   d. 1.000 $\pm$ .010 longitudinal center to center distance to 10th sprocket hole.
   e. 6.000 $\pm$ .015 longitudinal center to center distance to 60th sprocket hole.

D - Code Hole Diameter and Location.

   a. .072 $\pm$ .001 - .002 diameter of code holes.
   b. Code hole centers shall be located at multiple of .100 from the center of the sprocket hole in a transverse direction to the length of the tape. The tolerance on this dimension is $\pm$.002 for each code hole relative to the sprocket hole and are not accumulative.
   c. Code hole centers shall be on the same transverse centerline as the sprocket hole with a tolerance of $\pm$.003.

KJR:mlh

Approval Certified by Specifications Department



NOTES:

1. TAPE WIDTH DIMENSION IS VALID AT 73° ± 2.5° F., & 50% ± 2% RELATIVE HUMIDITY ONLY. ALL OTHER DIMENSIONS ARE TO BE MEASURED AT THE SAME ENVIRONMENTAL CONDITIONS UNDER WHICH THE TAPE WAS PUNCHED.
2. EACH CODE HOLE HAS A LONGITUDINAL TOLERANCE OF ± .003 IN RELATION TO ITS SPROCKET HOLE.

97A21377

CHANGES

THE NATIONAL CASH REGISTER CO.

CLASS 97 ORDER NO 87300

NAME PERFORATED PAPER TAPE STANDARD

REQ NO 20123-DK

DATE 3/29/62

DESIGNER CHR

PAGE 1 OF 1

97A21377

K-E 5 c

NCR ★ PURCHASING SPECIFICATION 7502.11

MATERIAL: COMMUNICATIONS PAPER FOR PERFORATOR TAPE.

REVISION 5	DATE 1-16-63	PAGES 2

A - General.

1. This specification establishes the purchase requirements for Communications Paper to be used in the manufacturing of dry and oiled perforator tape.

B - General Requirements.

1. This paper shall have a smooth finish, and be free from dirt specks, lint, holes and flaws. It shall be properly sized and finished for oiling. A uniform shade shall be maintained. Paper shall stand a reasonable storage period without discoloration.

2. This paper shall be furnished in rolls as continuous as possible. The number of breaks per roll shall never exceed one. All breaks shall be marked with cloth flags, and spliced with heat seal tape. Rolls shall be hard, true, and uniformly wound, free from cracks and soft spots.

3. Fiber composition of the paper is 100% Bleached Chemical Wood Pulp.

4. This paper should be flat and not curl under normal handling conditions.

C - Physical Requirements.

1. The Communications Paper should meet the following requirements:

Test	Test Method	Control Limits 49 lb.
Thickness	TAPPI 411	.0037" to .0043"
Basis Weight (24" x 36" 500 sheets)	TAPPI 410	49 Minimum
Bursting Strength (Mullen)	TAPPI 403	40 Minimum
Tear:		
Machine Direction	TAPPI 414	100 Maximum
Stiffness:		
Machine Direction	Gurley	200 Minimum
Cross Direction	Gurley	100 Minimum
Ash	Fed. Spec. UUT-120	1% Maximum
Grit	Fed. Spec. UUT-120	.04% Maximum
Fold - Machine Direction	Schopper	90 Double Folds Min.
Tensile (dry) Machine	TAPPI 404	40 lbs./in. Minimum
Opacity	TAPPI 425	70% Minimum
Fish Eyes	See Note 1	
Spliceability	See Note 1	

NOTE 1: The test for fish-eyes, and spliceability of punch tape will be conducted as outlined in N.C.R. Process Specification #720.01. The acceptability of this test as a control method shall be determined by mutual agreement between NCR purchasing and the vendors involved.

*D - Core and Roll Data.

1. Core shall be made from Kraft Fiber and shall have a wall thickness of at least 3/8 inch.

2. Inside diameter of core shall be 3 inches.

3. The maximum diameter of roll shall be 28 inches.

4. Rolls shall be as near maximum diameter as possible.

5. Rolls shall be wound with felt side out.

E - Control and Sampling.

1. Control and sampling of incoming shipments shall be in accordance with Process Specification 701.00 which is an NCR Specification and is available on request.

2. While samples may be taken from incoming shipments and checked according to this specification, the vendor shall accept the responsibility of shipments complying with the requirements of this specification, without dependence upon the buyer's inspection, which may be done at his option.

*F - Shipping.

1. All rolls shall be packed to prevent damage in shipment, packing subject to approval of The National Cash Register Company. The NCR purchase order number, name of the material, and manufacturer shall be plainly marked on the container.

2. "Felt Side Wound Out" shall be marked on outside of roll wrapper.

G - Rejections.

1. Material failing to meet the requirements of this specification will be rejected and returned to the manufacturer or dealer for replacement or full credit at the option of the purchaser. The shipper is to pay the freight both ways on rejected material.

H - Remarks.

1. All specifications for Base Paper for Perforator Tape, previously issued, are hereby cancelled.

*Revised

Approved by the Materials Committee

NCR TRADEMARK

PROCESS SPECIFICATION

720.01

SUBJECT: SLITTING PUNCH TAPE BASE PAPER.

REVISION 1	DATE 9-26-62	PAGES 1

A - General.
1. This specification covers the procedure for slitting Punch Tape Base Paper.
2. The paper used is Punch Tape Base Paper, Purchasing Specification 7502.11.

B - Procedure.
1. Keep slitting knives sharp. This will reduce dusting to a minimum.
2. Use the thinnest outside knife possible to reduce edge crimping.
3. Break corner of spacer to largest permissible radius. This also tends to reduce edge crimping by reducing strain on paper.

C - Quality Control.
1. Fish-Eyes - On the first mill roll processed on each purchase order, two (2) one thousand foot test tapes properly oiled, plus two (2) one thousand foot dry tapes shall run through a test fixture comparable optically to a C-361-1 Paper Tape Reader. The test fixture is to be such that read stations shall be so placed as to spot read the entire width of the tape alllowing for edge clearance. The light source shall be equivalent to that of the C-361-1 Paper Tape Reader, and shall operate at 100% of the rated voltage rather than at the reduced voltage specified for the reader. Under these conditions two (2) test tapes oiled, and two (2) test tapes dry must pass through the test fixture without the indication of one (1) measurable error. If one or more errors are indicated then five (5) additional 1000 foot rolls of the offending type are to be selected at random, and tested without errors before the stock is considered acceptable.
2. Spliceability
   a. A sample tape (above) must comply with the splicing tests set forth in the Paper Tape Specifications 417B14 Paragraph C-1. A minimum of five (5) splices must be checked without failure.
   b. A series of twenty-five (25) test splices must also be checked through the optical test fixtures referred to in the above section (C-1) without error indication to meet required approval.

GGJ:bmk

Approval Certified by Specifications Department

SECTION 3. IMPLEMENTATION DATA

3.0 INTRODUCTION

The NCR EM-B2 Paper Tape Punch is designed for use with Electronic Data Processors which require a punched paper tape output. For proper operation, the Tape Punch must be supplied with operating power and electrical signals from a controlled external source. This section describes associated hardware which is essential for proper operation of the Tape Punch.

3.1 POWER SUPPLY

The associated power supply must be capable of supplying the required AC and DC input power to the Tape Punch as specified in paragraph 2.2. In addition, the power supply may be used to furnish operating power for associated logic circuits magnet drivers, etc..

3.2 CONTROL LOGIC CIRCUITS

External control logic circuits are required to properly control the punching and feeding of paper tape. The punch and feed magnet input pulses must be synchronized with the outputs of the electromagnetic pickup heads as shown in Figure 3-1.

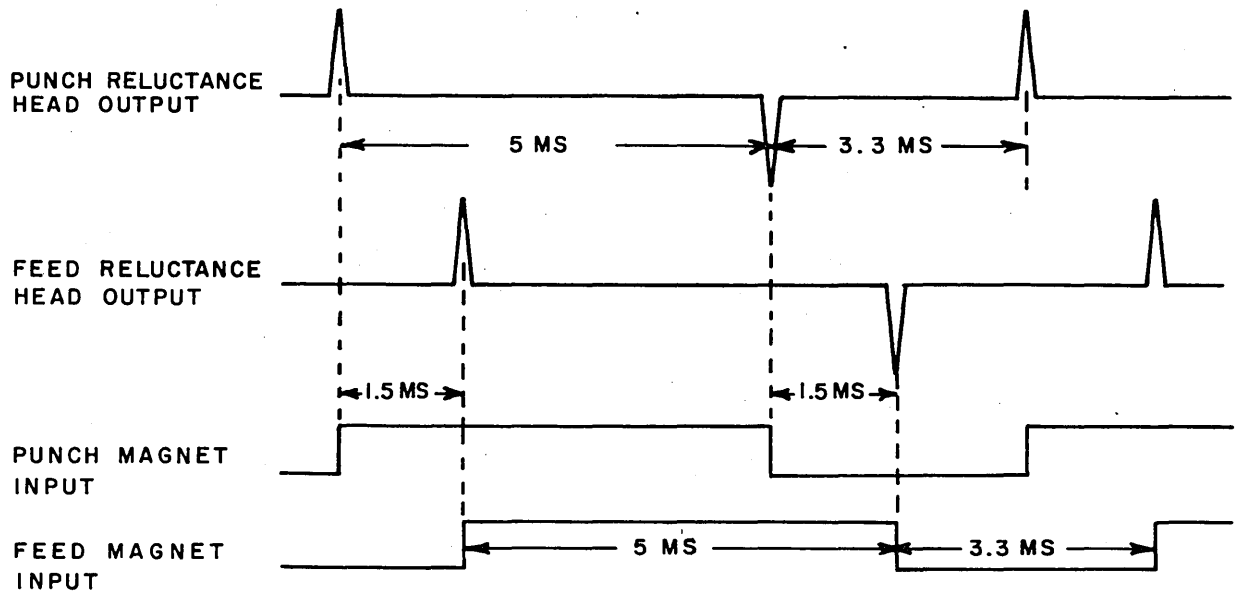
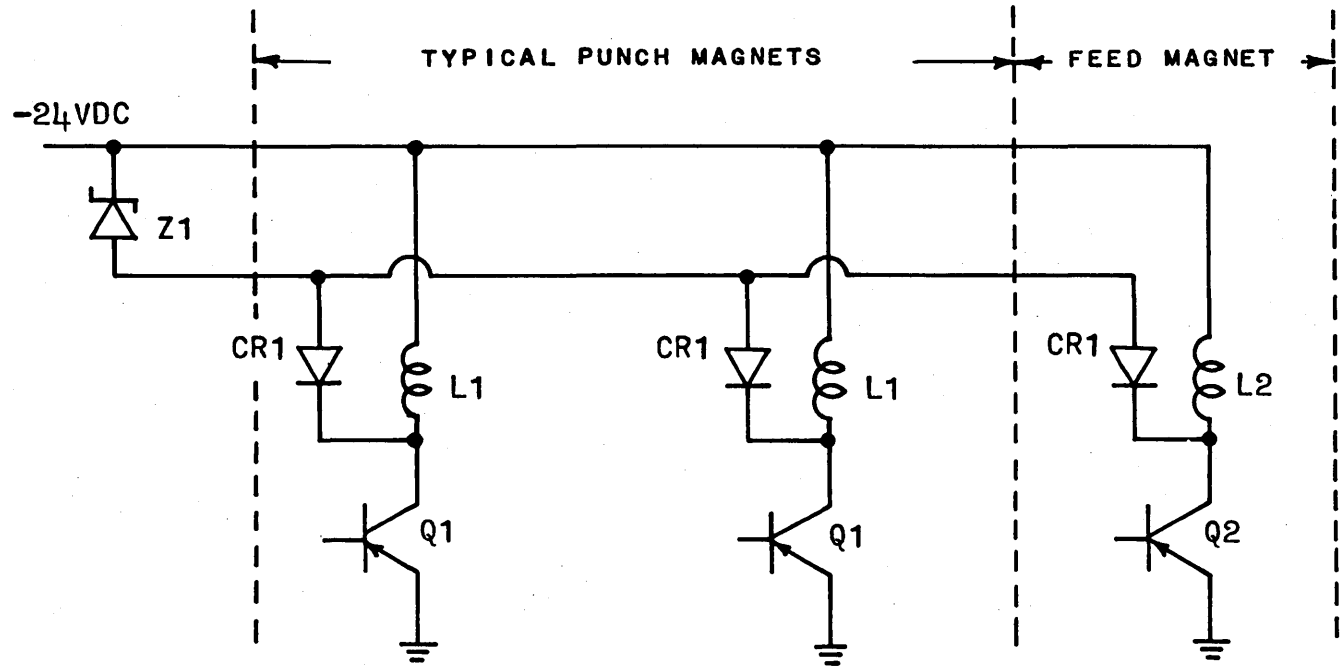


FIGURE 3-1. PUNCH AND FEED MAGNET PULSE TIMING.

This insures that the punch and feed pulses are delivered to the Punch Head at the proper time in its mechanical cycle. The control logic also performs logical operations on the various inputs from the Processor, Punch Head, Tape Transport, and the operator controls to prevent the transfer of punch data from the Processor and to disconnect operating power from the drive motors while tape is being loaded, or when tape breaks, or when the supply of tape on the supply reel is low.

3.3 MAGNET DRIVER CIRCUITS

Punch and feed magnet driver circuits must be provided to furnish magnet pulses which meet the requirements of paragraph 2.2. A suggested circuit for the magnet driver is shown in Figure 3-2. The punch and feed magnets should have 24 ±2v DC



Z1 = 8V ±5%, 10W ZENER DIODE
TRANSITRON SV-2011

CR1 = SILICON DIODE INTERNATIONAL RECTIFIER 5A4

Q1 = 2N380
Q2 = 2N1073

L1 = PUNCH MAGNET COIL
L2 = FEED MAGNET COIL

FIGURE 3-2. PUNCH AND FEED MAGNET DRIVER CIRCUIT.

across their coils. Line and transistor drops must be accounted for by increasing the supply voltage. Diodes CR1 and Z1 are provided to rapidly de-energize the magnets when the driving transistor is turned off. This is necessary to insure that

the magnet armatures are released swiftly enough to prevent erroneous actuation of the punch and feed mechanisms during the next cycle. The magnet current must decay as shown in Figure 2-7.

3.4 OPERATOR CONTROLS

Operator controls must be provided to allow manual control of the Tape Punch. These controls are used in conjunction with the control logic circuits to control the Tape Punch, the punching of tape leader, and the inhibition of punche and feed pulses from the Processor during tape loading.

3.5 PUNCH HEAD AND TRANSPORT MATING INFORMATION

Prior to mating the Punch Head and Transport, refer to paragraph 4.2 for adjustments which may be required by either of these units.

SECTION 4. SERVICE DATA

4.0 INTRODUCTION

This section provides service information for the NCR EM-B2 Paper Tape Punch. The service information is divided into two parts: preventive maintenance and adjustment procedures.

4.1 PREVENTIVE MAINTENANCE

The preventive maintenance instructions contained in the following paragraphs are designed to keep the maintenance down-time of the Tape Punch at a minimum. The frequency of preventive maintenance is determined by the machine usage. A frequency versus usage schedule is included at the beginning of each maintenance procedure.

Although the preventive maintenance procedures are intended for service personnel, it is important that the operator be concerned with the exterior cleanliness of the punch. The exposed area around the punch block and paper track should be cleaned of tape dust and chaff daily or after punching 10,000 feet of tape (10 rolls), whichever comes first. A soft lint-free cloth or brush should be used. Care should be exercised so that damage is not caused to the punch. The punch and die block assembly area can be cleaned by using a strip of paper, moving it to the right and left through the punching area to clean out paper dust and chaff that may have accumulated therein.

Reference to Sub-section 4.2 should be made when the performance of an adjustment procedure is required by the preventive maintenance instructions.

Reference to Figures 1-3, 2-2 and 2-3 should be made for the location of Tape Transport lubrication and adjustment points. Figure 4-1 illustrates the location of Punch Head lubrication and adjustment points. The numbers in parenthesis at the end of each step of the Punch Head procedures reference the location of lubrication points in Figure 4-1.

Unless otherwise specified, NCR lubricant #801 should be used for all lubrication requirements. Use a small brush for application of a thin film (0.005 inch to 0.010 inch). Table 4-1 lists the applicable lubricant by quantity and stock number.

Table 4-1
Lubricants Required

Lubricant	Stock Number						
	1 oz.	2 oz.	3 oz.	1/2 pt.	1 qt.	1 gal.	5 gal.
NCR 801 (1) NCR 803 (3) NCR 805 (5)			R46552	R46415	R46554	R46553 R46555 R46557	R46550
R8593		R8593(2 oz)			R8593(1 qt)	R8593(1 gal)	
Shell Alvania EP #1	R58903(1 oz)				R58903(1 qt)		

4.1.1 Schedule #1. This maintenance is based on the normal usage of the EM-B2 of (22) days per month.

Time Interval	Maintenance Frequency
0-8 hours/day	Every (4) weeks (176 hours)
8-16 hours/day	Every (2) weeks
16-24 hours/day	Every week

The following action must be performed after the usage as noted above or after punching 200,000 feet of paper tape (200 rolls) if this occurs more often than the frequency of the time schedule.

4.1.1a Tape Transport. Clean the entire transport mechanism on the face (outside) of the mounting plate.

4.1.1b Punch Head (Figure 4-1).

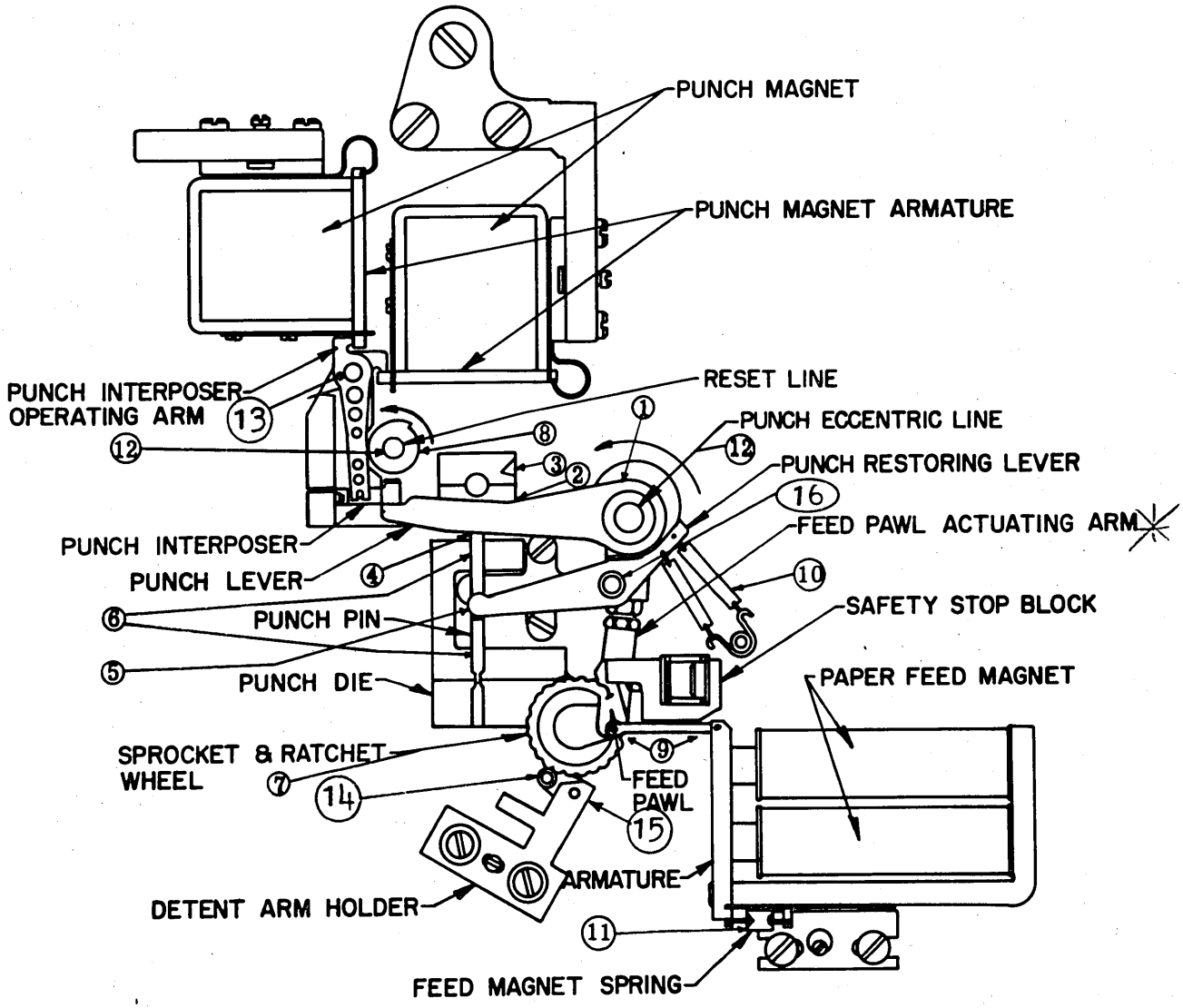


FIGURE 4-1. LOCATION OF PUNCH HEAD LUBRICATION POINTS.

1. Remove the paper guide, being careful to move the block downward in order that the spring wires are not bent on the sprocket and ratchet wheel.

2. Remove all paper dust from the assembly.

3. Remove all paper dust along the paper track.

4. Lubricate between punch levers and the top surface of the punch levers from the eccentric line vertical centerline around to the right to the eccentric line horizontal centerline. Use approximately one drop of NCR 80 / #[illegible] medium lubricating oil for each lever. (1)

5. Apply thin film in the slots of the punch lever comb. Apply on right side above punch lever. (2)

6. Apply NCR #R8593 medium lubricating oil as required to fill the five holes in the side of the punch lever comb. (3)

7. Apply thin film to camming surfaces of the punch restoring levers and punch levers.

8. Apply Shell Alvania EP #1 gear lubricant on the punch levers and punch pins where these items contact each other. (4)

9. Apply Shell Alvania EP #1 gear lubricant on top surface of punch restoring levers where these levers contact the punch pins. (5)

10. Fill both wells on the guide block with Shell Alvania EP #1 gear lubricant where the punch pins enter the punch guide block. (6)

11. Apply thin film of lubricant on all ratchet teeth of the sprocket and ratchet wheel and also on the feed pawl on those surfaces that contact the sprocket and ratchet wheel. (7)

12. Evenly apply three drops NCR #803 lubricant on reset line across surface which cams the punch interposer operating arms. (8) (The punch interposer, interposer operating arms and punch interposer guide block are lubricated during assembly with NCR #805 lubricant. Excess build-up of lubricant in this area will degrade the punch performance. Build-up of lubricant must be removed from all parts and then these parts must be relubricated with NCR #805 lubricant.)

13. Apply NCR #803 lubricant on both bearing surfaces of the magnetic link where link contacts armature link pin and the feed pawl. (9)

14. Apply a thin film around both ends of the reset line and the punch eccentric line where the lines contact the inner rings of the ball bearings. Also apply where line contacts the inner rings of the bearings in the punch frame. (12)

15. Check the following assembly and operational adjustments (per Sub-section 4.2) and reset if they are not within the proper adjustment:

    A. Detenting Pressure (paragraph 4.2.2e)
    B. Safety Block and Feed Pawl Clearance (paragraph 4.2.2g)

C. Feed Pawl Actuating Arm Length (paragraph 4.2.2h)
D. Feed Magnet Setting (paragraph 4.2.2i)
E. Longitudinal Spacing of Adjacent Codes (paragraph 4.2.2q)

4.1.2 Schedule #2. This maintenance is based on the normal usage of the EM-B2 of (66) days per quarter.

Time Interval	Maintenance Frequency
0-8 hours/day	Every (12) weeks (528 hours)
8-16 hours/day	Every (6) weeks
16-24 hours/day	Every (4) weeks

The following maintenance action must be performed after the usage as noted above or after punching 400,000 feet of paper tape (400 rolls) if this occurs more often than the frequency of the time schedule. Complete the maintenance schedule shown below and include the requirements of Schedule #1.

4.1.2a Tape Transport.

1. Lubricate all cam surfaces and their actuator rolls; all latch arm bearing areas, all spring eyes, and the bearing areas of the spring coils.

2. Check, adjust if necessary, motor control switch SC305, brake control switch SC304, tension arm latch switches SC302 and SC303, and tape low sensing switch SC301.

3. Check, adjust if necessary, the tape brake.

4. Lubricate the two adjustable guide rolls sparingly with NCR #803 lubricant, wipe off excess and check for ease of operation. If the roll sleeve tends to bind, disassemble the roll sleeve from the roll core by removing the screw plate (held by the three screws visible from the front). Thoroughly clean the balls, holes, spring and keyways. Lubricate with NCR #803 lubricant and reassemble. When disassembling roll, care should be taken to prevent loss of the spring loaded ball.

5. Lubricate supply and take-up motor gear trains and couplings.

4.1.2b Punch Head.

1. Evenly apply three drops of NCR #805 lubricant to the punch interposer operating arms where these arms contact the punch interposer arm shaft. (The punch interposers, interposer operating arms, and punch interposer guide block are lubricated during assembly with NCR #805 lubricant. Excess build-up of lubricant in this area will degrade punch performance. Build-up must be cleaned from these parts and then the parts must be relubricated with NCR #805 lubricant.)

2. Lubricate the detent roll with NCR #803 lubricant. (14)

3. Lubricate the felt oiler on the detent arm holder with NCR #R8593 medium lubricating oil. (15)

4. Lubricate the punch lever shaft where this shaft makes contact with the punch restoring levers with NCR #803 lubricant. (16)

5. Apply a thin film to both ends of detent spring.

6. Apply a thin film to both ends of the nine punch restoring springs. (10)

7. Apply a thin film to both ends of the feed magnet spring. (11)

4.1.3 Schedule #3. This maintenance is based on the normal usage of the EM-B2 of (132) days bi-annually.

Time Interval	Maintenance Frequency
0-8 hours/day	Every (24) weeks (1056) hours
8-16 hours/day	Every (12) weeks
16-24 hours/day	Every (8) weeks

Complete the maintenance schedule shown below and include the requirements of Schedule #1 and Schedule #2.

4.1.3a Tape Transport.

1. Saturate the supply and take-up motor and the gear train wicks with NCR #803 lubricant and remove excess.

2. Sparingly lubricate all spacing washers on rotating shafts on the face of the mounting plate with NCR #803 lubricant.

4.1.3b Punch Head.

1. Lubricate the magnet cooling blower with 4 drops of NCR #803 lubricant in both oil holes.

2. Apply Shell Alvania EP #1 gear lubricant to the gear teeth of motor gear and also to the teeth of both of the pinions in mesh with the motor gear.

4.1.4 Overhaul. On those punches equipped with a steel guide block, additional punch and die life is possible by replacing only the worn code and punch pins with new pins. Pin replacement is not recommended on punches with a porous bronze guide block.

The following schedule should be used as a basis for replacement of the punch and die set with a new set or, if economically justifiable, for pin replacement only.

Parts	Life
New punch and die set	400 to 450 rolls
1st set of replacement pins	350 to 400 rolls
2nd set of replacement pins	250 to 300 rolls

After punching a number of rolls of paper tape, as decided from the above schedule, remove the punch head from the transport, replacing the unit with a replacement

punch head. The removed punch head should be returned to a service center for disassembly, cleaning, replacement of worn parts, re-assembly and resetting of all adjustments. Note, do not clean bronze parts or ball bearings in a solvent as all bronze is oil impregnated and the bearings are sealed with a lubricant.

At this time the punch and die assembly is replaced. Note that when replacing punch pins in the punch (steel) guide assembly use part 371X937 for the 8 code pins and the largest diameter size of the three sprocket pins (371X96, 371X961 or 371X962) which will fit without binding when the pin notch is turned towards the mounting surface.

During the time the unit is disassembled check for wear on the following parts, replacing worn parts when required.

Feed Pawl, part number 371A103
Detent Arm Holder, part number 371A1656
Sprocket and Ratchet Wheel, part number 371C284
Punch Levers, part number 371A243
Punch Restoring Levers, part number 371A89
Punch Lever Pivot Shaft, part number 371A74
Paper Guide, part number 371A255
Bearings

Note that if any of the above parts are not replaced at this time, these parts should be checked for wear at more frequent intervals (every 200 rolls) thereafter.

When reassembling the Punch Head, perform all the adjustments specified in paragraph 4.2.2. Re-lubricate in accordance with schedule #2 of the periodic maintenance procedure.

The unit should be operated sufficiently to wear in the new parts, then recheck the tape registration and adjustments described in paragraphs 4.2.2c, 4.2.2d, 4.2.2e, 4.2.2f, 4.2.2g, 4.2.2h, 4.2.2i, and 4.2.2o, resetting if necessary.

The Punch Head is now ready for installation.

4.2 ADJUSTMENT PROCEDURES

The adjustment procedures contained in the following paragraphs are designed for use during periodic maintenance, repair, and overhaul.

All adjustment dimensions are to be initially set as close to the nominal dimensions as possible. Tolerances are given to show the allowable set-up range. The Reset Range, as given at the end of most adjustments, is to allow for wear-in of parts and indicates the point at which the adjustment should be re-made to the original.

The adjustments are given in the order that they would be done if all were to be made or checked. In most cases changing one adjustment will affect the following ones sufficiently so as to necessitate a check or correction of those at the same time.

4.2.1 Tape Transport. The following adjustment procedures are required to determine if the Tape Transport is functioning properly.

4.2.1a Paper Feed Rolls (Figure 4-2).

1. Side registration of punching in the paper tape is the distance from the "guide" edge of the tape to the feed holes as shown in Figure 4-16. This dimension must be maintained at 0.392 inch +0.003 inch. Side registration is dependent on the side spacing of the adjustable guide rolls. If registration is not within limits, change side spacing by varying the number or thicknesses of washers under the hex shoulder of the Guide Roll Stud until the tape is punched to proper side registration.

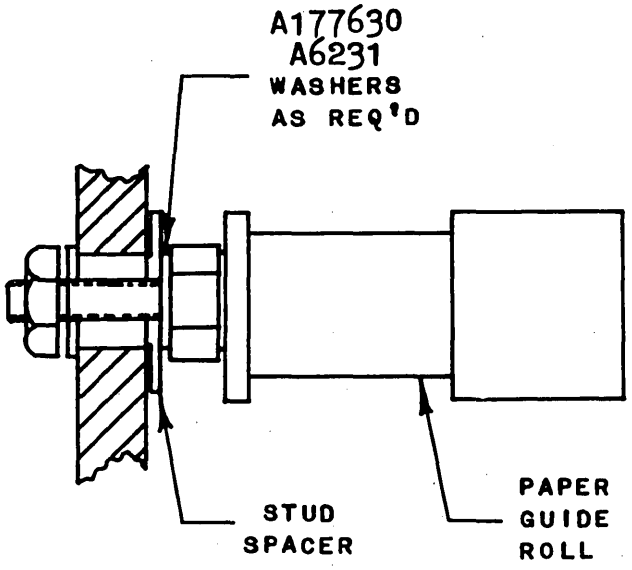


FIGURE 4-2. PAPER FEED ROLL ADJUSTMENT.

2. Align roll on supply (input) side of the Punch Head vertically to allow paper to lay flat on the paper tape guide. Do not allow paper to drag across the corners of the punch cover or paper tape guide.

3. Align roll on take-up (output) side of the Punch Head so that the paper that is running unsupported between the punch head and roll is parallel to the lower horizontal surface of the paper guide.

4.2.1b Switches and Actuators (Figure 2-2 and 2-3).

CAUTION

In all of the following adjustments the switch button must not "bottom" under normal operating conditions and the switch must transfer to the "rest" state when released to low dwell or other stopping surface.

1. Adjust the motor control switch SC305 and the brake control switch SC304 to operate when their respective tape tension arms are 5/8 inch (± 1/8) from the rubber faced stop. These switches are to be adjusted to transfer when the actuating roll is .036" above the low dwell of the cam.

2. Adjust the latch switches SC302 and SC303 to operate on the low dwell of the cam when their respective arms are latched. Adjust the stop tab on the actuator so that the roll will contact the 45° starting ramp on the cam when it is rotated into the latched position. Position these actuators so that they will not interfere with the adjacent actuators.

3. Adjust the tape low sensing switch SC301 to meet the following conditions:

a. Switch transfers when the actuating roll is .Q36" above the low dwell of the cam.

b. Normally open contact is open when sensing arm is latched.

c. Switch contacts transfer when sensing arm is at least 1/8" above a full roll of paper tape and remain so throughout the downward travel of the arm until condition at "d" is met.

d. Switch contacts transfer back to the beginning state (normally open contact is open) when sensing arm is resting on a roll of paper tape having approximately 25 feet of tape remaining on the paper core.

4.2.1c Brake Adjustment (Figure 4-3).

1. Loosen the four mounting screws on the back of the mounting plate holding the brake assembly and shoe holder.

2. With the Brake Shoe retracted (bottomed) in the shoe holder, position the Brake Assembly in relation to the shoe holder so that a .010 to .040 inch clearance is maintained between the shoe and brake assembly. Position the Holder so that the Brake Shoe is flush on the surface of the Brake Assembly.

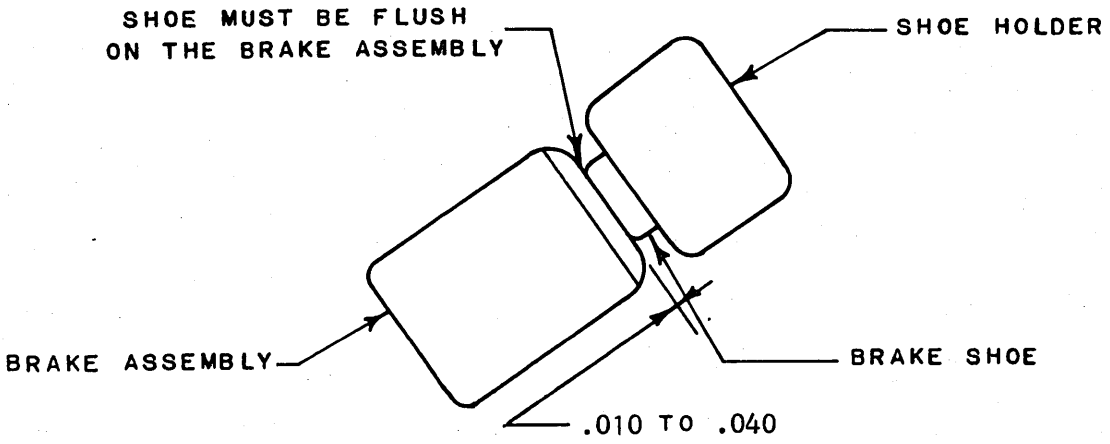


FIGURE 4-3. TAPE BRAKE ADJUSTMENT.

3. Tighten the 4 mounting screws.

4. Check the adjustment after tightening the mounting screws.

5. Feed at least two feet of tape from the punch head at maximum speed and bring to an abrupt halt. The brake must be capable of stopping the take-up reel before the rolls on the tension arm swing to a point where they are even with the rolls on the idler mounting plate.

4.2.2 Punch Head. The following special tools are required for adjustment of the Punch Head.

Quantity	Item	NCR Stock No.
1	Feeler Gauge 0.004 inch	34523012
1	Feeler Gauge 0.003 inch	34523013
1	Sprocket Positioning Tool	32078111
1	Torque Wrench Assembly	371B1391
1	Shim Stock 0.0005 inch (1 ft. length)	34319
2	Plug Gauges	34508006
1	Tape Registration Gauge	T18118

For convenience in making adjustments, the Punch Head can be removed from the Tape Transport frame. For added convenience, the drive motor, the motor frame, and the rear frame can also be removed as one unit.

4.2.2a Punch Head Removal.

1. Remove the plug from connector P1.

2. Remove the Punch Head from the Tape Transport frame by removing the five mounting screws.

4.2.2b Rear Punch Frame Removal.

1. Disconnect the drive motor leads.
2. Remove four nuts holding the rear punch frame.
3. Remove the rear punch frame.

4.2.2c Clearance Between The Feed Pawl and The Sprocket and Ratchet Wheel (Figure 4-4).

1. This clearance may be checked with the unit as is, if a small enough gauge is available. However, to change the clearance, some parts must be removed, such as the paper guide, tape guide shoe, and sprocket wheel.

2. Disconnect the lower end of the feed pawl actuating arm from the feed pawl arm by unscrewing the adjusting screw so that it can be removed to add or remove spacers.

3. Add ratchet wheel spacers (371A619) 0.002 inch, (371A622) 0.005 inch, and (371A623) 0.010 inch as required between the sprocket shaft flange in the feed pawl arm to obtain a 0.002 +0.004, -0.000 inch clearance between the feed pawl tenon and the sprocket wheel. Always use the thickest possible washer adjacent to the feed pawl arm.

4. Reset if the clearance after a period of use is not within a 0.0005 to 0.007 inch range.

4.2.2d Sprocket Wheel Radial Location (Figure 4-5).

1. Replace the feed pawl actuating arm. Replace feed pawl, tape feed linkage, and feed sprocket wheel. Note that the sprocket wheel is mounted with the flat side down so as to present a round surface to the tape, the full distance that the tape touches it. This is a preliminary adjustment for proper longitudinal registration.

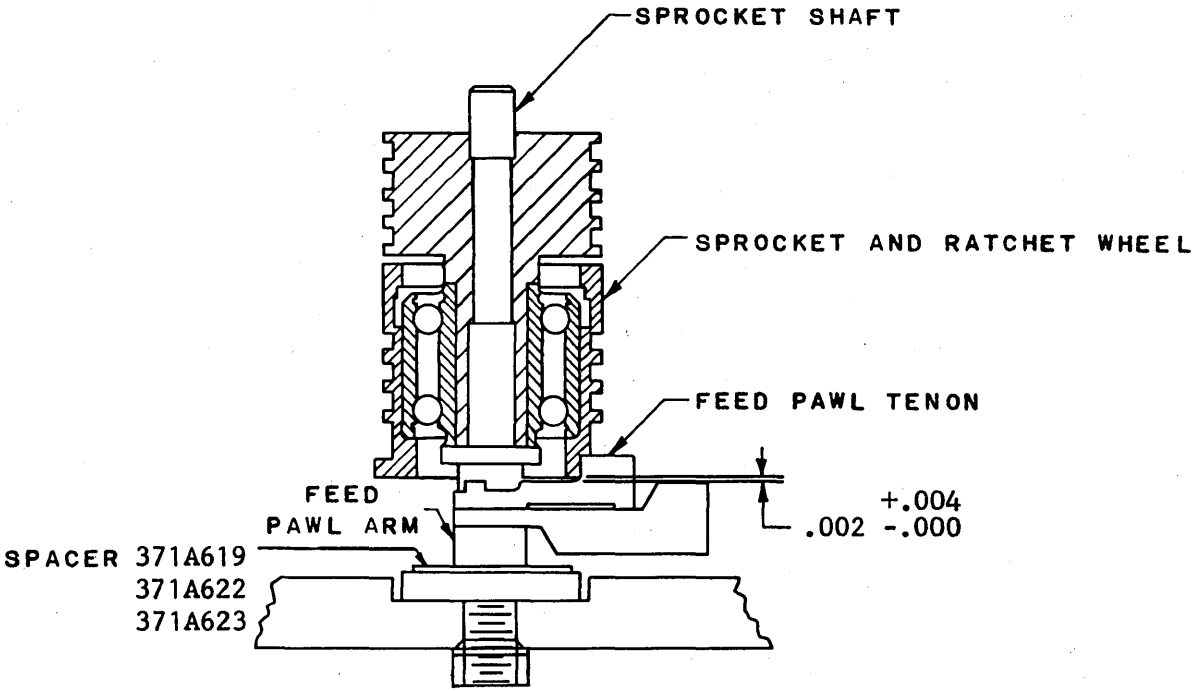


FIGURE 4-4. CLEARANCE BETWEEN THE FEED PAWL AND THE SPROCKET AND RATCHET WHEEL.

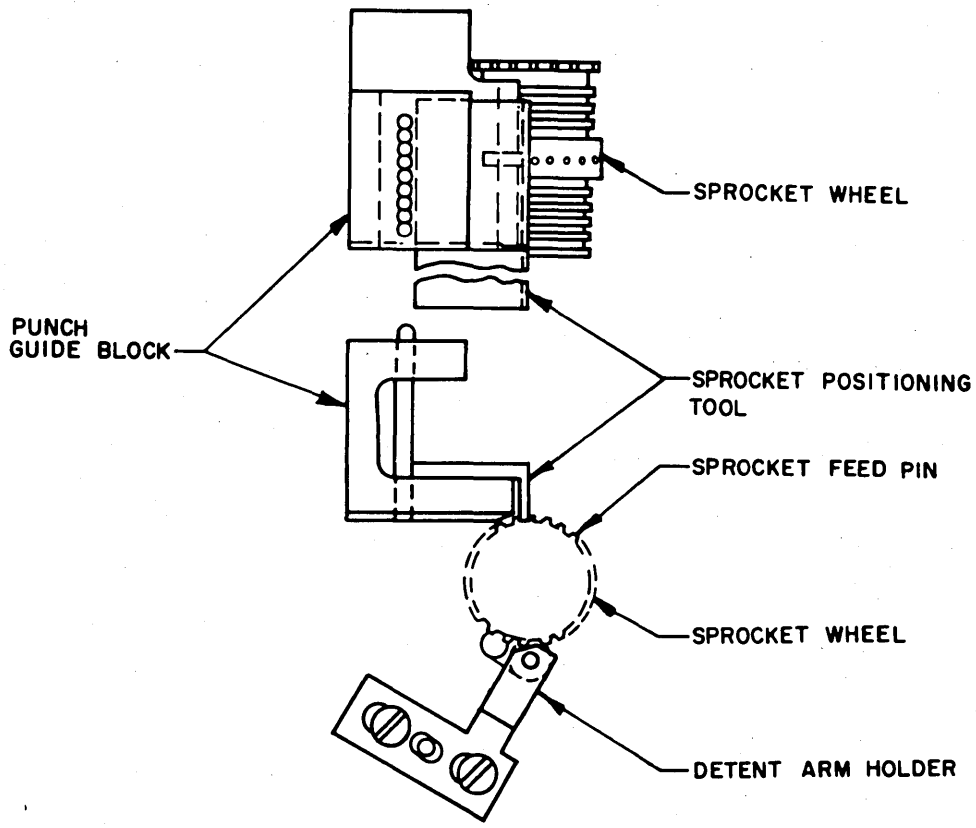


FIGURE 4-5. SPROCKET WHEEL RADIAL LOCATION.

2. Use sprocket positioning tool (32078111) to adjust the radial location of the sprocket wheel. The right front face of the tool is to make contact with a sprocket feed pin without moving the sprocket wheel. The left face of the tool is to contact the 0.0930 diameter of the punch pins. The punch pins should be in the maximum downward position. This adjustment is made by shifting the detent arm holder. Loosen the two locking screws on the holder and adjust the eccentric screw until correct. Then tighten the screws and check again. Proper longitudinal registration is the final check and should determine the position of the detent.

4.2.2e Detenting Pressure, Tape Feed (Figure 4-6).

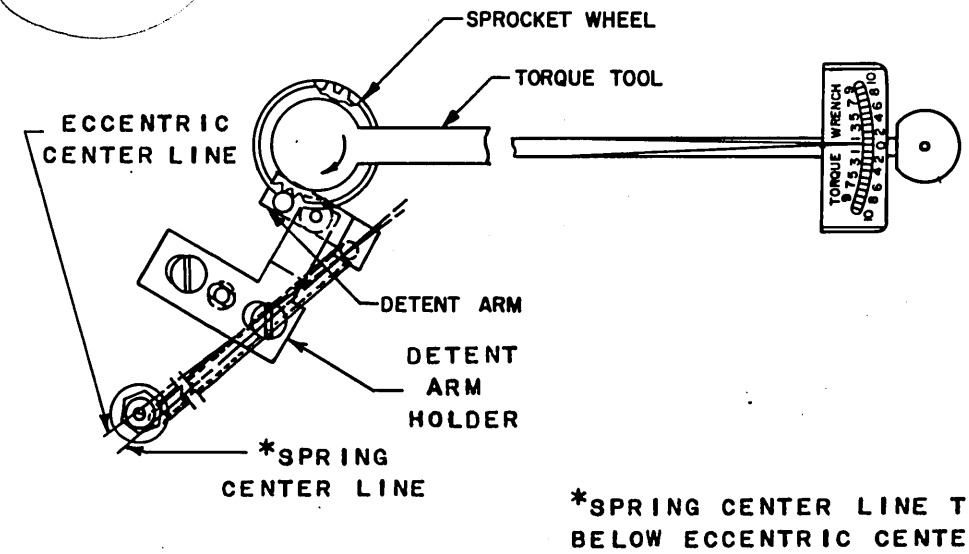


FIGURE 4-6. DETENTING PRESSURE, TAPE FEED.

1. Use the special torque tool and attachment (371B1391) on the sprocket wheel to check the adjustment of the detent arm. 12 to 15 inch-ounces of torque is required to index or turn the sprocket wheel and may be varied by changing the position of the eccentric stud.

2. Reset this adjustment whenever, through use, the torque is not in a 12 to 15 inch-ounces range.

4.2.2f Clearance Safety Stop Block to Front Face of Feed Pawl (Figure 4-7).

1. Replace the safety stop block. There should be a 0.006 +0.005 -0.000 inch clearance between the front face of the feed pawl and the safety stop block. To obtain this, add shims (371A949) 0.005 inch, (371A620) 0.002 inch and (371A621) 0.003 inch as necessary.

2. Reset if this clearance changes to be outside the 0.006 to 0.012 range.

4.2.2g Safety Block and Feed Pawl Clearance (Figure 4-8).

1. Operate to cause the feed pawl to be in a full downward position of its stroke with force applied against the ratchet tooth. There should be 0.001 +0.002, -0.000 inch clearance between the spring plunger and the feed pawl at this time. To obtain this, add or remove washers (371X673)

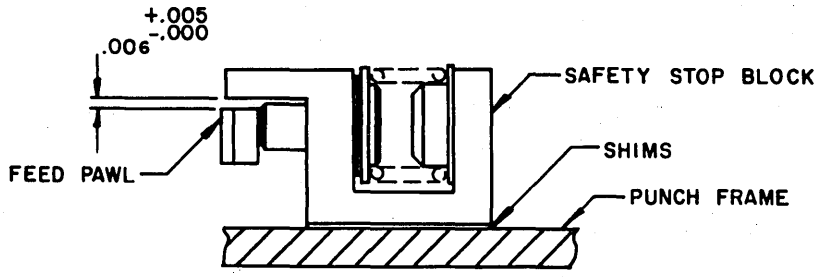


FIGURE 4-7. CLEARANCE BETWEEN SAFETY STOP BLOCK AND FRONT FACE OF FEED PAWL.

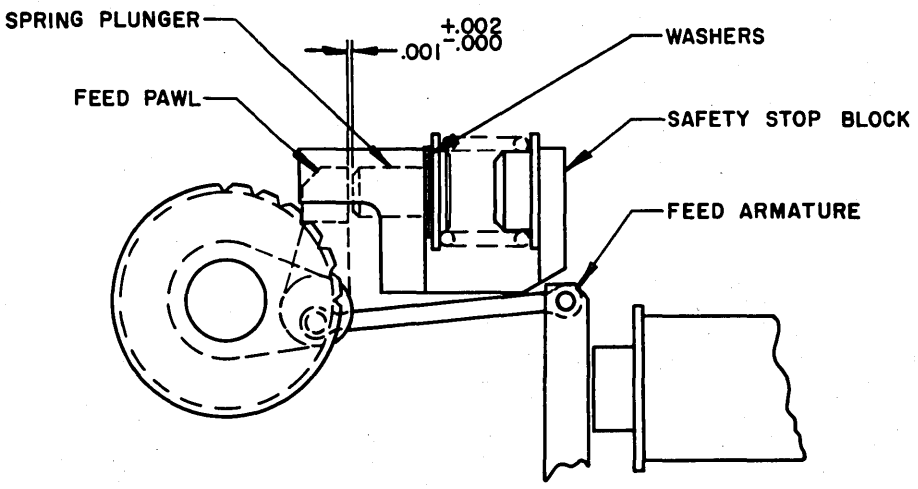


FIGURE 4-8. CLEARANCE BETWEEN SAFETY STOP BLOCK AND FEED PAWL.

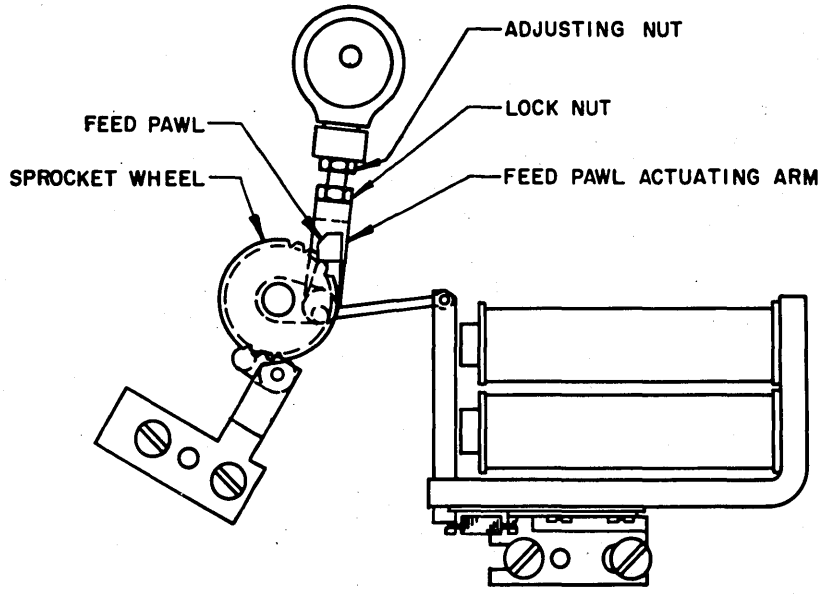


FIGURE 4-9. FEED PAWL ACUTATING ARM LENGTH.

0.005 inch (371X672) 0.003 and/or (371X671) 0.002 inch as needed between the spring plunger and the safety stop block.

2. Reset if the clearance varies outside a 0.0005 to 0.004 inch range.

4.2.2h Feed Pawl Actuating Arm Length (Figure 4-9).

1. Adjust position of feed pawl actuating arm so that the bottom working surface of the feed pawl contacts the top of the ratchet tooth without imparting radial motion to the sprocket wheel at the maximum downward position of the feed pawl stroke. The adjustment is to be made with the lock nut loose.

2. After adjusting, tighten the lock nut and check the adjustment.

4.2.2i Feed Magnet Setting (Figure 4-10).

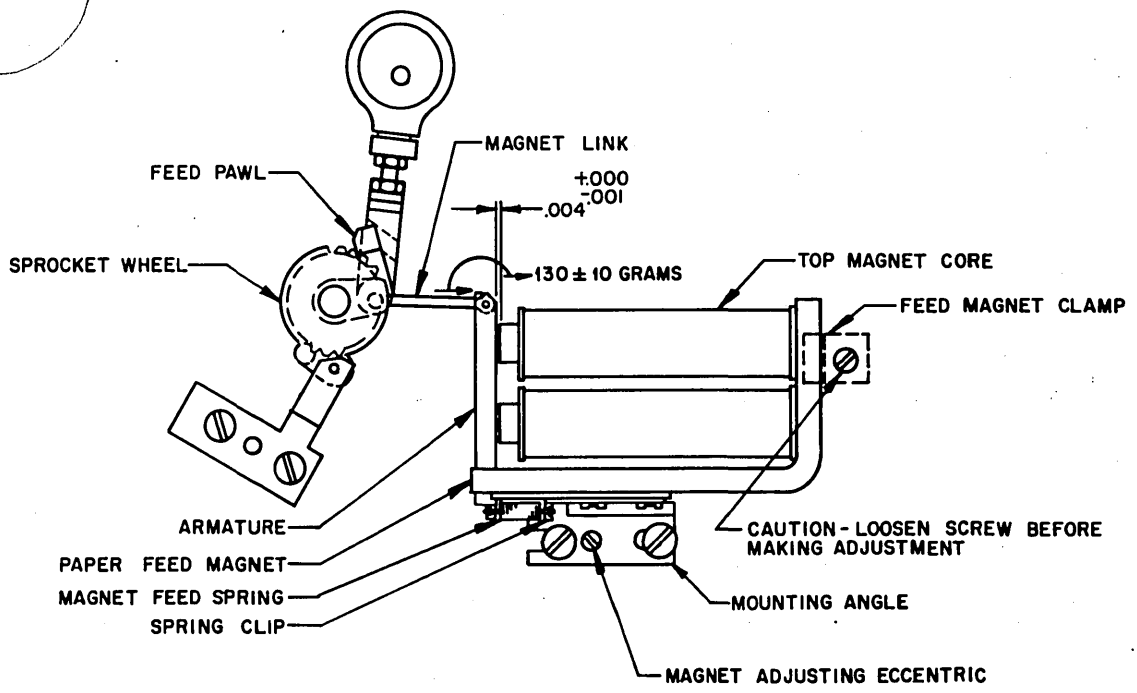


FIGURE 4-10. FEED MAGNET SETTING.

1. Loosen the feed magnet clamp and the two screws that hold the mounting angle. Adjust the paper feed magnet using the magnet adjusting eccentric to obtain a 0.004 +0.000, -0.001 inch clearance between the armature and the top magnet core with the feed pawl engaged in the full throw position at the top of the feed pawl stroke. (Maximum clearance between the bottom surface of the feed pawl and the ratchet tooth).

2. Tighten all screws and recheck clearances. Reset if clearance is not within a 0.0025 to 0.005 inch range.

4.2.2j Locate Gears and Replace Motor Frame (Figure 4-11).

1. Insert two plug gauges (34508006) or suitable pins through the rear frame. Align the timing holes in the reset pinion and drive pinion with these pins. Bring the back frame together with the main frame allowing the drive and reset gears to mesh with the motor gear.

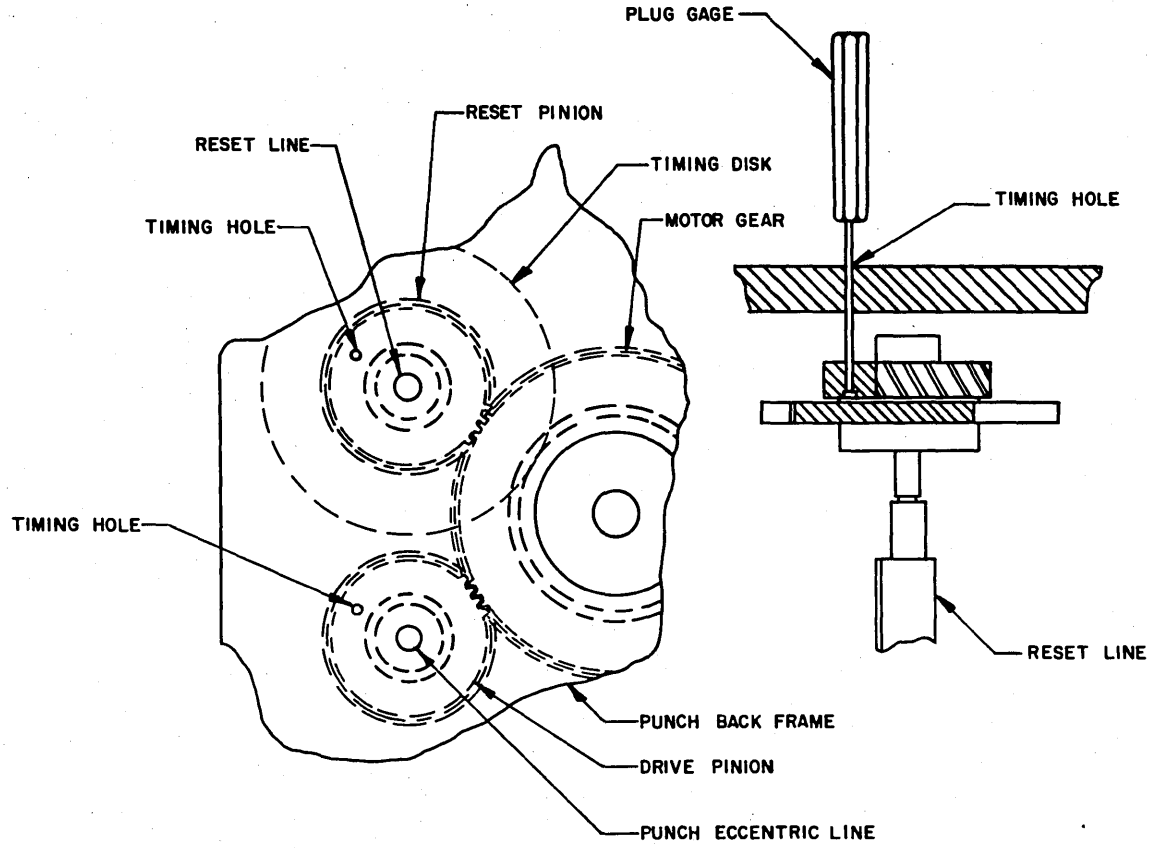


FIGURE 4-11. TIMING AND BACKLASH.

2. Install the four nuts, flat washers and lock washers.

3. Check the gears for 0.002 +0.003, -0.000 inch backlash. To obtain this, the four nuts holding the motor frame to the rear frame may be loosened and the motor frame shifted for proper gear mesh.

4. Remove the plug gauges.

5. Reset when backlash is not within a 0.001 to 0.006 inch range.

4.2.2k Clearance Between Interposers and Punch Levers (Figure 4-12).

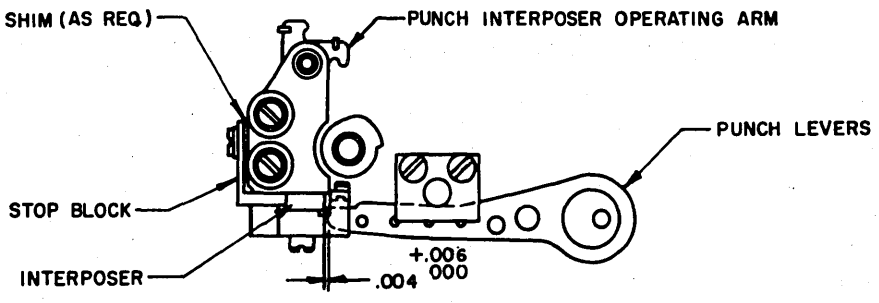


FIGURE 4-12. CLEARANCE BETWEEN INTERPOSERS AND PUNCH LEVERS.

1. With the punch levers extended to the maximum position toward the interposers, adjust the position of the stop block using shims (371A617) 0.003 inch and/or (371A618) 0.005 inch as required, so that the interposer clears the end of the punch lever by 0.004 +0.006, -0.000 inch.

2. Check the adjustment after the screws are tightened on the stop block. This setting should be for all of the interposers and levers.

3. Reset if the clearance is less than 0.003 inch or more than 0.011 inch on all levers and interposers.

4.2.21 Clearance Between Punch Levers and Restoring Arms (Figure 4-13).

1. With the maximum throw of the punch eccentric line turned toward the punch restoring lever cam surface, there should be 0.0005 +0.000, -0.0005 inch clearance between the closest punch restoring lever and its punch lever. If a 0.0005 inch feeler gauge or shim stock is used to make the check, insert the gauge and rotate the punch eccentric line. At this line's maximum throw toward the punch restoring levers, the 0.0005 inch gauge should be a tight fit. Without the gauge there should be no rubbing between the restoring lever and punch lever.

2. To correct the setting, loosen the lock nut on the punch restoring shaft and rotate the shaft clockwise to decrease the clearance or counterclockwise to increase it. The shaft will not turn 360 degrees and should be turned almost fully clockwise at the time of proper adjustment. Rotate the punch eccentric line to determine its maximum throw. Tighten the lock nut and check again.

3. Reset if the closest gap is not within a 0.0000 to 0.0007 inch range.

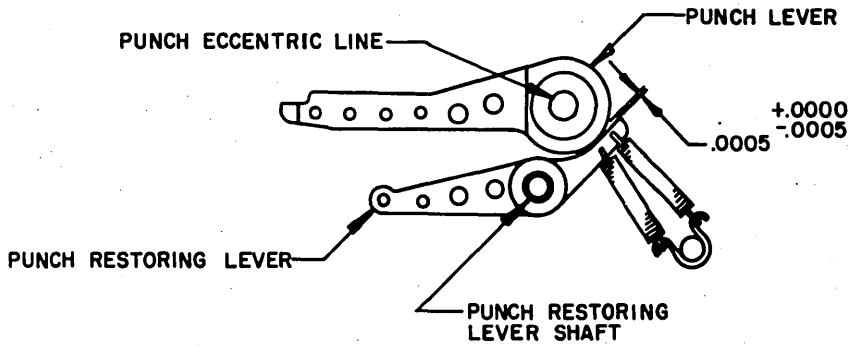


FIGURE 4-13. CLEARANCE BETWEEN PUNCH LEVERS AND PUNCH RESTORING ARMS.

4.2.2m Punch Magnet Location (Figure 4-14).

1. Should readjustment of any one punch magnet become necessary, the following adjustment can be made without disturbing the other magnets. A standard feeler gauge may be used, although for ease of insertion, the gauge may be trimmed to a narrow strip. Rebuilding and adjusting an individual punch magnet is covered at the end of the adjustment procedures. Rotate the reset line until the interposers are free to advance against the interposer stop block and adjust each magnet as follows:

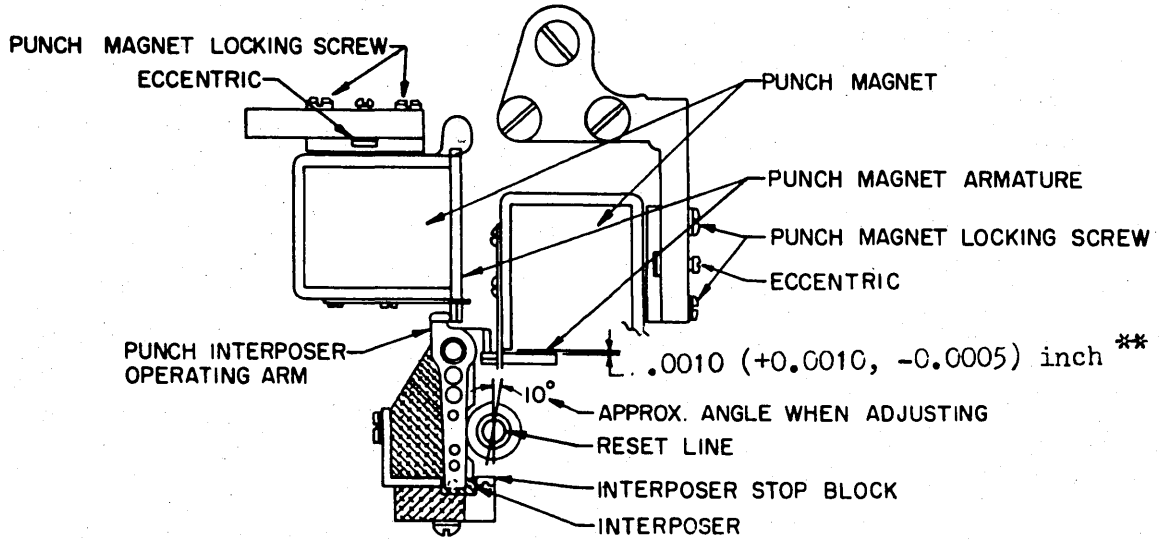


FIGURE 4-14. PUNCH MAGNET ADJUSTMENT.

(a) Hold the armature against the interposer operating arm, bringing the interposer against the stop block.

(b) Loosen the punch magnet locking screw.

** (c) Adjust the punch magnet by means of the eccentric until a 0.0010 inch gage will fit snugly between the armature and the magnet frame, adjacent to the armature stop strip. Gap must be between 0.0005 and 0.0020 inch.

(d) Tighten magnet locking screws with 6 ±0.5 inch-pounds of torque.

** (e) Check for 0.0010 inch gap after the magnet locking screws have been tightened since the tightening may also alter the gap. Reset if the clearance is not between 0.0005 and 0.0020 inch.

4.2.2n Magnetic Pick-Up Gap (Figure 4-15).

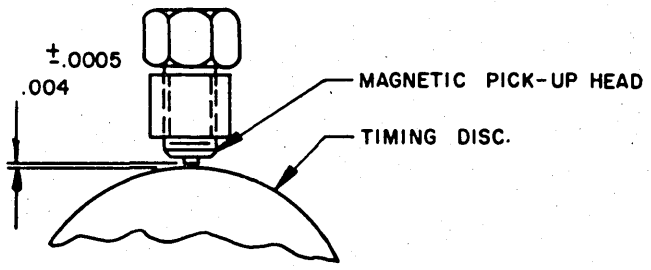


FIGURE 4-15. MAGNETIC PICKUP GAP.

** Indicates changed information

1. The gap between the two magnetic pick-up heads and the timing discs should be 0.004 ±0.0005 inch with its lock nut tight.

2. Reset if the gap is not within a 0.003 to 0.005 inch range.

4.2.2o Feed Magnet Armature Return Spring Force (Figure 4-10).

1. The position of spring clip should be adjusted so that the magnet feed spring exerts a force of 130 ±10 grams measured at a point on the armature above the magnet link, with the force applied toward the magnet.

2. Reset if the spring force is not within a 115 to 180 gram range.

4.2.2p Tape Side Registration (Figure 4-16).

1. The center line of the sprocket feed holes in the tape should be 0.392 ±0.003 inch or 25/64 inch from the back edge of the tape.

2. Adjust the paper guide to hold the tape toward the back snugly against the punch guide block.

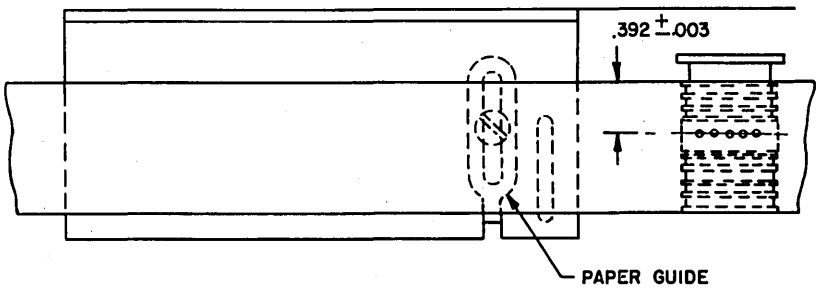


FIGURE 4-16. TAPE SIDE REGISTRATION.

4.2.2q Longitudinal Spacing of Adjacent Codes (Figure 4-17).

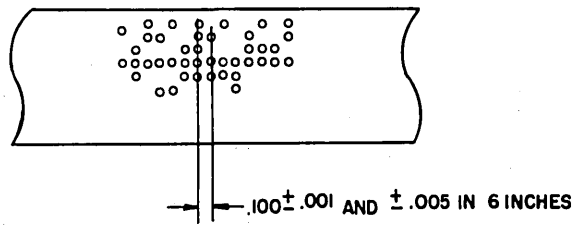


FIGURE 4-17. LONGITUDINAL SPACING OF ADJACENT CODES.

1. Mount the Punch Head into the Tape Transport, attach P-1, and operate.

2. After a trial run check the paper tape for longitudinal spacing of adjacent codes. The correct spacing should be 60 codes in 6.000 inches + or -0.005 inch and one code in 0.100 + or - 0.001 inch. If variations of these occur, then adjustment items 4.2.2d, e, g, h, and i should be referred to and rechecked.

3. Reset if the spacing of 60 codes in 6.000 inches is not within a + or -0.015 inch range when operating.

4.2.2r Punch Magnet Gap (Figure 4-18).

1. Set the magnet gap at 0.020 +0.001, -0.000 inch by adjusting the armature stop strip. Measure the gap adjacent to the stop strip between the armature and the magnet frame.

2. Reset if the magnet gap is not within a 0.0195 to 0.0215 inch range.

4.2.2s Armature Retainer Force (Figure 4-18).

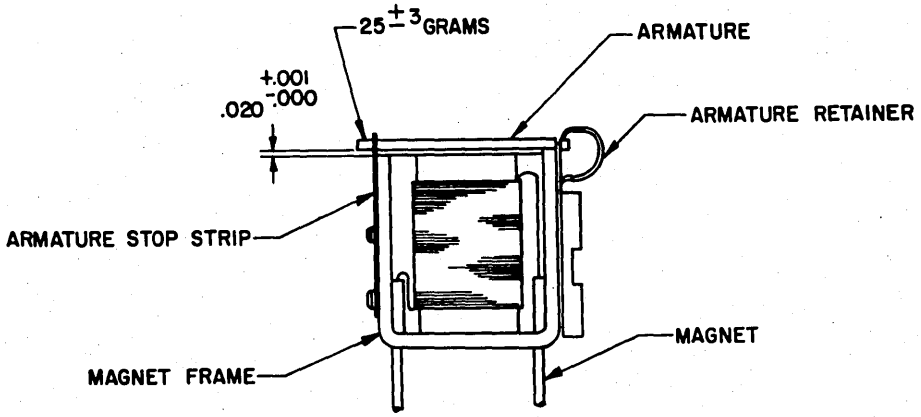


FIGURE 4-18. PUNCH MAGNET ARMATURE GAP AND TENSION.

1. Adjust the armature until a force of 25 ±3 grams, measured at the end of the armature nearest the stop strip, is required to move the armature off the stop strip.

2. Reset if the spring pressure is not within a 20 to 30 gram range.

NOTE

When running the Tape Punch without programing control, care must be taken to not punch all data holes continuously for extended periods of time.

4.2.2t Punch Head and Cover.

1. Position the punch mounting platform (shock mount bracket) by sliding along the screw slots until the punch head is approximately centered in the opening in the mounting plate.

2. Adjust the upper shock mount to position the punch main plate parallel to the front surface of the transport mounting plate and about 0.040 inch behind the front surface.

3. Attach the punch cover and adjust vertically by shifting the cover hangers along their screw slots to attain alignment between the paper tape guide of the punch head and the opening in the punch cover.

4. (a) Check clearance between the paper tape guide and the left end of the opening in the punch cover.

   (b) Compare the clearance between the paper guide and the opening at the lower center of the punch cover to 4 (a).

   (c) If clearances 4 (a) and 4 (b) are not approximately equal repeat steps 1 and 2, aligning to the punch cover instead of the opening in the mounting plate.

5. Check and adjust if necessary the alignment between the punch head chad chute and the transport chad chute. If the clearance on the right and left sides of the joint is not approximately equal, loosen the transport chad chute mounting screws, shift it to its proper position, and retighten screws.

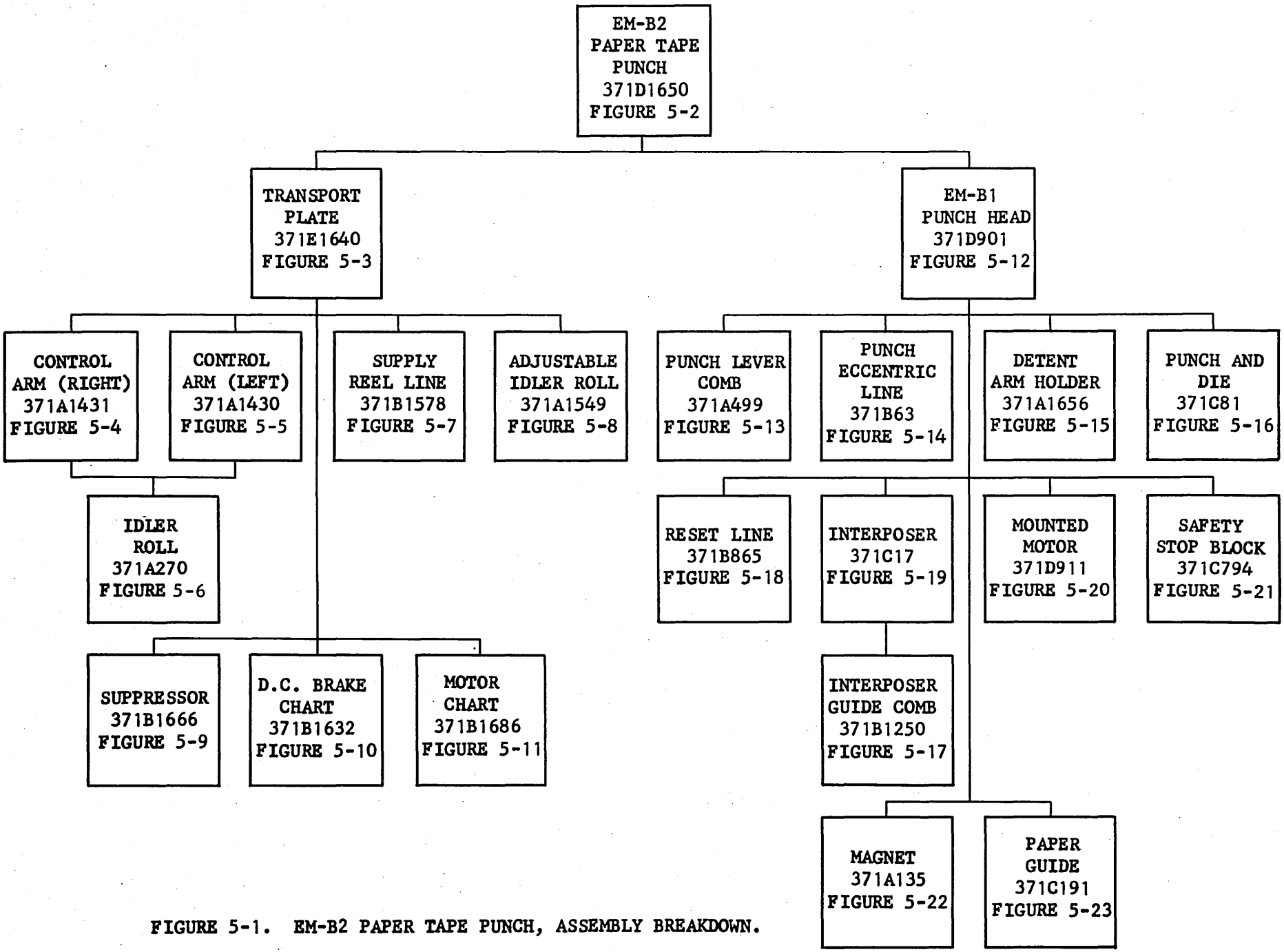


FIGURE 5-1. EM-B2 PAPER TAPE PUNCH, ASSEMBLY BREAKDOWN.

EM-B2 PAPER TAPE PUNCH, 371D1650
PARTS LIST
FIGURE 5-2

LTR.	DRAWING NO.	PART NAME	REQ. 371X1649	REQ. 371X1648	REQ. 371X1691	REQ. 371X1692	REFS. FIG.	REFS. PAGE
A	371X1639	Transport, EM-B2 (Chart 371E1640) (60 cps)	1				5-3	5-7
B	371X800	Punch, Paper Tape (Chart 371D901) (60 cps)	1		1		5-12	5-22
C	371D1510	Cover, Punch	1	1	1	1		
D	371B1413	Chute, Chad	1	1	1	1		
E	371A1507	Screw, Thumb	1	1	1	1		
F	97A20866	Screw (10-32 X 9/16)	4	4	4	4		
G	Purchase	Washer, #10 Lock (#5440008)	5	5	5	5		
H	97A17786	Nut, Hex (10-32 X 3/8 X 1/8)	1	1	1	1		
I	A181451	Washer, Return Feed #2	1	1	1	1		
J	370B133	Core, Tape Center (1")	1	1	1	1		
K	370B186	Core, Tape Center (7/8")	1	1	1	1		
L	370B187	Core, Tape Center (11/16")	1	1	1	1		
M	371X1638	Transport - EM-B2 (Chart 371E1640) (50 cps)		1			5-3	5-7
N	97A3997	Plate, Factory Number #4	1	1	1	1		
O	97A22671	Screw, P.H.	1	1	1	1		
P	97A17935	Screw, P.H. (6-32 X 3/16)	1	1	1	1		
Q	Purchase	Washer, External Shakeproof (#1106-00)	1	1	1	1		
R	371X1695	Transport, EM-B2 (Chart 371E1640) (60 cps)			1		5-3	5-7
S	371X1696	Transport, EM-B2 (Chart 371E1640) (50 cps)				1	5-3	5-7
T	371X900	Punch, Paper Tape (Chart 371D901) (50 cps)		1		1	5-12	5-22

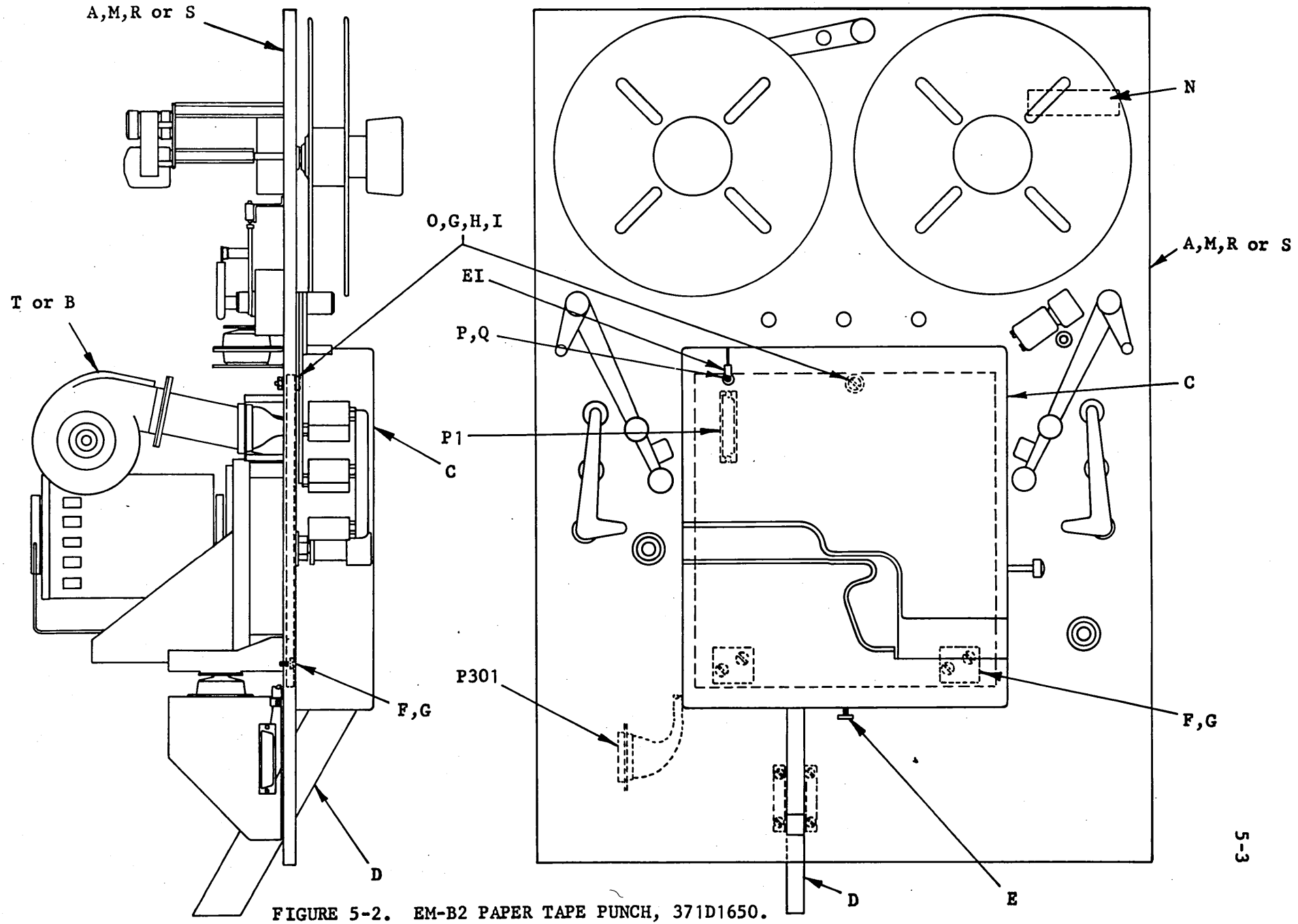


FIGURE 5-2. EM-B2 PAPER TAPE PUNCH, 371D1650.

TRANSPORT PLATE, 371E1640
PARTS LIST
FIGURE 5-3

LTR.	DRAWING NO.	PART NAME	REQ. 371X1639	REQ. 371X1638	REQ. 371X1695	REQ. 371X1696	REFS. FIG.	REFS. PAGE
A	450A9209	Disc, Coupling	2	2	2	2		
B	51A6823	Screw, Indicator Switch Adjusting	6	6	6	6		
C	371B1578	Line, Supply Reel	2	2	2	2	5-7	5-13
D	371A1683	Stud	3	3	3	3		
E	371X1687	Motor (60 CPS Takeup) (371B1686)	1		1		5-11	5-17
F	371X1688	Motor (60 CPS Supply) (371B1686)	1		1		5-11	5-17
G	371A1684	Stud	4	4	4	4		
H	371A1587	Latch Arm	2	2	2	2		
I	371A1582	Line, Tension Arm (Take Up)	1	1	1	1		
J	97A15594	Screw, Pan Head Machine (8-32 x 1/4)	10	10	10	10		
K	PA4765026	Actuator	5	5	5	5		
L	97A18289	Screw, Pan Head (8-32 x 5/8)	4	4	4	4		
M	370A204	Key, Drive	2	2	2	2		
N	361A360	Screw, Reel	2	2	2	2		
O	361A361	Nut, Reel	2	2	2	2		
P	361A599	Reel, Tape (Front)	2	2	2	2		
Q	361C603	Reel, Tape Supply (Rear)	2	2	2	2		
R	371B1540	Mount, Punch Shock	1	1	1	1		
S	100A198768	Sleeve, Paper Retainer Stud #1	2	2	2	2		
T	97A22672	Nut, Hex. (10-32 x 3/8 x 1/8)	8	8	8	8		
U	423A168	Spring, Return	2	2	2	2		
V	371A1588	Stud, Spring	2	2	2	2		
W	371A1685	Bracket	2	2	2	2		
X	362A148	Cover, Relay	1	1	1	1		
Y	371A1455	Housing, Control Arm	3	3	3	3		
Z	97A21359	Screw, Flat Head (8-32 x 1-1/8)	9	9	9	9		
AA	371B1447	Line, Sensing Arm	1	1	1	1		
AB	371A1446	Arm, Sensing	1	1	1	1		
AC	97A23062	Pin, Spring (.156 x 5/8)	2	2	2	2		
AD	371A1454	Hub, Supply Roll	1	1	1	1		
AE	61A8577	Washer, Cross Lockout Yoke	A.R.	A.R.	A.R.	A.R.		
AF	61A8578	Washer, Cross Lockout Yoke	A.R.	A.R.	A.R.	A.R.		
AG	371A1460	Bracket, Switch	5	5	5	5		
AH	97A18287	Screw (4-40 x 3/16)	10	10	10	10		
AI	Purchase	Washer, Internal Shakeproof (#1204)	12	12	12	12		
AJ	700A160	Washer, Rev. Rack Pawl Stud	2	2	2	2		
AK	421A1150	Plate, Screw	5	5	5	5		
AL	421A841	Insulator	5	5	5	5		
AM	95A15375	Screw, Lamp Jack	10	10	10	10		
AN	371A1505	Hanger, Cover	2	2	2	2		
AO	P5900207	Relay	1	1	1	1	5-5	5-11
AP	371A1430	Arm, Control (Left)	1	1	1	1		
AQ	361A247	Handle, Control Arm	1	1	1	1		
AR	371A1506	Block, Cover Latch	1	1	1	1		
AS	371X1417	Plate, Mounting (Chart 371E1700)	1	1				

TRANSPORT PLATE, 371E1640
PARTS LIST
FIGURE 5-3

LTR.	DRAWING NO.	PART NAME	REQ. 371X1639	REQ. 371X1638	REQ. 371X1695	REQ. 371X1696	REFS. FIG.	REFS. PAGE
AT	371A1558	Brake Assembly	1	1	1	1		
AU	371A1560	Holder, Shoe	1	1	1	1		
AV	90D1080-14	Tubing, Insulating (Chart 90B72791)	2	2	2	2		
AW	5000EA41	Clip, Drawer Catch Release Lever Stud	4	4	4	4		
AX	361A246	Button, Latch Release	3	3	3	3		
AY	97A12710	Clip, Stud	3	3	3	3		
AZ	361A236	Bracket, Latch	3	3	3	3		
BA	PA6030057	Resistor, Wirewound	1	1	1	1		
BB	97A20815	Screw, Pan Head (6-32 x 1/2)	10	10	10	10		
BC	30A15998	Spring, Column Selecting Stop Arm	1	1	1	1		
BD	97A17934	Screw, Pan Head (6-32 x 1/8)	10	10	10	10		
BE	450A9264	Screw, Frame	3	3	3	3		
BF	421A2269	Nut, Hex. (8-32 x 11/32 x 1/8)	3	3	3	3		
BG	Purchase	Washer, #8 Lock (#5440005)	23	23	23	23		
BH	Purchase	Washer, #6 Lock (#5440002)	27	27	27	27		
BI	371B1452	Arm, Latch	1	1	1	1		
BJ	97A15586	Screw, Machine (4-40 x 3/8)	2	2	2	2		
BK	371A1431	Arm, Control (Right)	1	1	1	1	5-4	5-11
BL	361A315	Stop	2	2	2	2		
BM	97A20866	Screw, Pan Head (10-32 x 9/16)	4	4	4	4		
BN	Purchase	Washer, #10 Lock (#5440008)	18	18	18	18		
BO	371X1689	Motor (50 CPS Take Up) (371B1686)		1		1	5-11	5-17
BP	371B1531	Plate, Idler Mounting	1	1	1	1		
BQ	Purchase	Washer, 1/4 Lock (#5440011)	4	4	4	4		
BR	N2000A82749	Screw, Indicator Side Frame Dowel #3	4	4	4	4		
BS	371B1530	Plate, Idler Mounting	1	1	1	1		
BT	371A1549	Roll, Adjustable Idler	2	2	2	2	5-8	5-13
BU	371A1481	Spacer, Stud	2	2	2	2		
BV	2000A65580	Washer, Co. Shifting Cam Support Stud	2	2	2	2		
BW	97A17844	Nut, Hex. (5/16-18 x 9/16)	2	2	2	2		
BX	Purchase	Washer, Countersunk Shakeproof (#1508)	9	9	9	9		
BY	371D1412	Bracket, Shockmount	1	1	1	1		
BZ	371D1633	Harness, EM-B2	1	1	1	1		
CA	97A23086	Mounting, Multiplane	2	2	2	2		
CB	371X1631	Brake, D.C. (Chart 371B1632)	1	1	1	1	5-10	5-15
CC	97A23087	Washer, Snubbing (J-2049-2D)	4	4	4	4		
CD	97A15546	Screw, Pan Head Mach. (6-32 x 5/8)	2	2	2	2		
CE	100A177630	Washer, Pinion #1	A.R.	A.R.	A.R.	A.R.		
CF	97A23305	Screw, Hex. Head Cap (1/4-20 x 1-1/2)	2	2	2	2		
CG	371X1690	Motor (50 CPS Supply) (371B1686)		1		1	5-11	5-17
CH	371A1561	Shoe, Brake	1	1	1	1		
CI	371B1411	Bracket, Punch Support	2	2	2	2		
CJ	PA6400035	Diode	1	1	1	1		
CK	29A6657	Receptacle, Taper Tab	2	2	2	2		
CL	371A1528	Spacer	1	1	1	1		

TRANSPORT PLATE, 371E1640
PARTS LIST
FIGURE 5-3

LTR.	DRAWING NO.	PART NAME	REQ. 371X1639	REQ. 371X1638	REQ. 371X1695	REQ. 371X1696	REFS. FIG.	REFS. PAGE
CM	Pruchase	Washer, 5/16 Lock (#5440016)	2	2	2	2		
CN	90B72768	Switch, Snap Action	5	5	5	5		
CO	371A1457	Shim	A.R.	A.R.	A.R.	A.R.		
CP	97A19745	Screw (8-32 x 5/16)	6	6	6	6		
CQ	1200A6231	Washer, Type Driving Seg. Stud	A.R.	A.R.	A.R.	A.R.		
CR	2000A31500	Washer, Ind. Control Lever Stud	10	10	10	10		
CS	1700A43007	Washer, Co. Locating Pitman	A.R.	A.R.	A.R.	A.R.		
CT	371A1584	Line, Tension Arm (Supply)	1	1	1	1		
CU	371A1619	Bracket, Relay	1	1	1	1		
CV	97A25477	Pin, Spring (.156 x 9/16)	1	1	1	1		
CW	97A661	Spring, Bell Hammer Stop Lever (#1087)	2	2	2	2		
CX	371B1666	Suppressor	1	1	1	1	5-9	5-15
CY	97A21354	Screw, P.H. (2-56 x 9/16)	2	2	2	2		
CZ	PA5403008	Suppressor, Spark	1	1	1	1		
DA	97A19717	Screw, Pan Head Mach. (6-32 x 1/4)	12	12	12	12		
DB	97A17927	Screw, Pan Head Mach.	1	1	1	1		
DC	Purchase	Washer, Int. Tooth Shakeproof (#5441008)	1	1	1	1		
DD	461A9131	Clip, Cable	3	3	3	3		
DE	371A1693	Cover, Safety			1	1		
DF	90A72834	Terminal, Wire	2	2	2	2		
DG	361A1029	Screw	1	1	1	1		
DH	371A1682	Shaft, Tape Guide	1	1	1	1		
DI	1000A42218	Spring, Key (#2013)	1	1	1	1		
DJ	371B1681	Guide, Tape	1	1	1	1		
DK	371A1694	Stud, Screw			4	4		
DL	371X1699	Plate, Mounting (Chart 371X1700)			1	1		
DM	Purchase	Insulating Material			A.R.	A.R.		
DN	97A21802	Screw, Soc. Set (6-32 x 3/16 Nylok)	1	1	1	1		

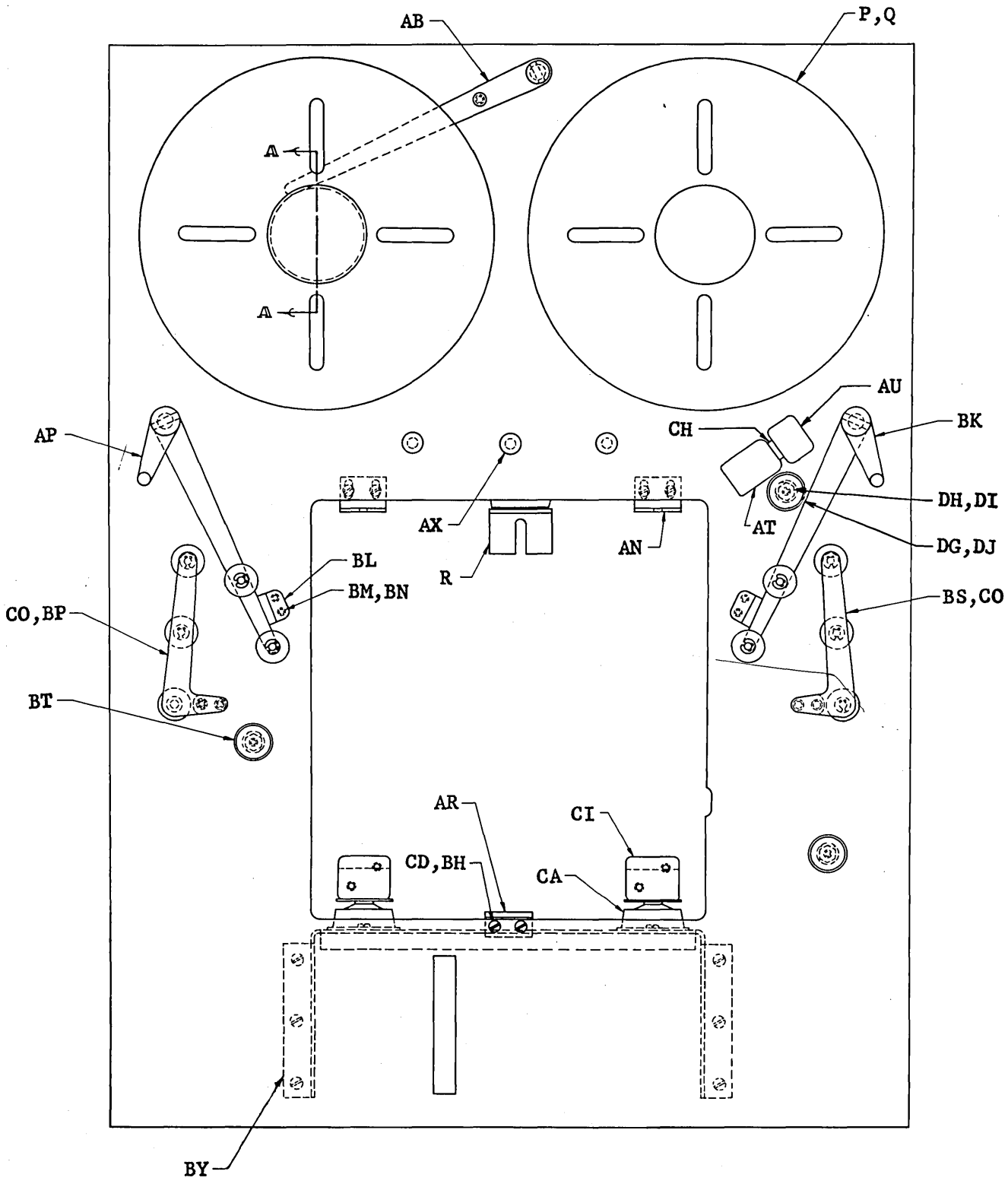


FIGURE 5-3. TAPE TRANSPORT PLATE, 371E1640 (SHEET 1 OF 3).

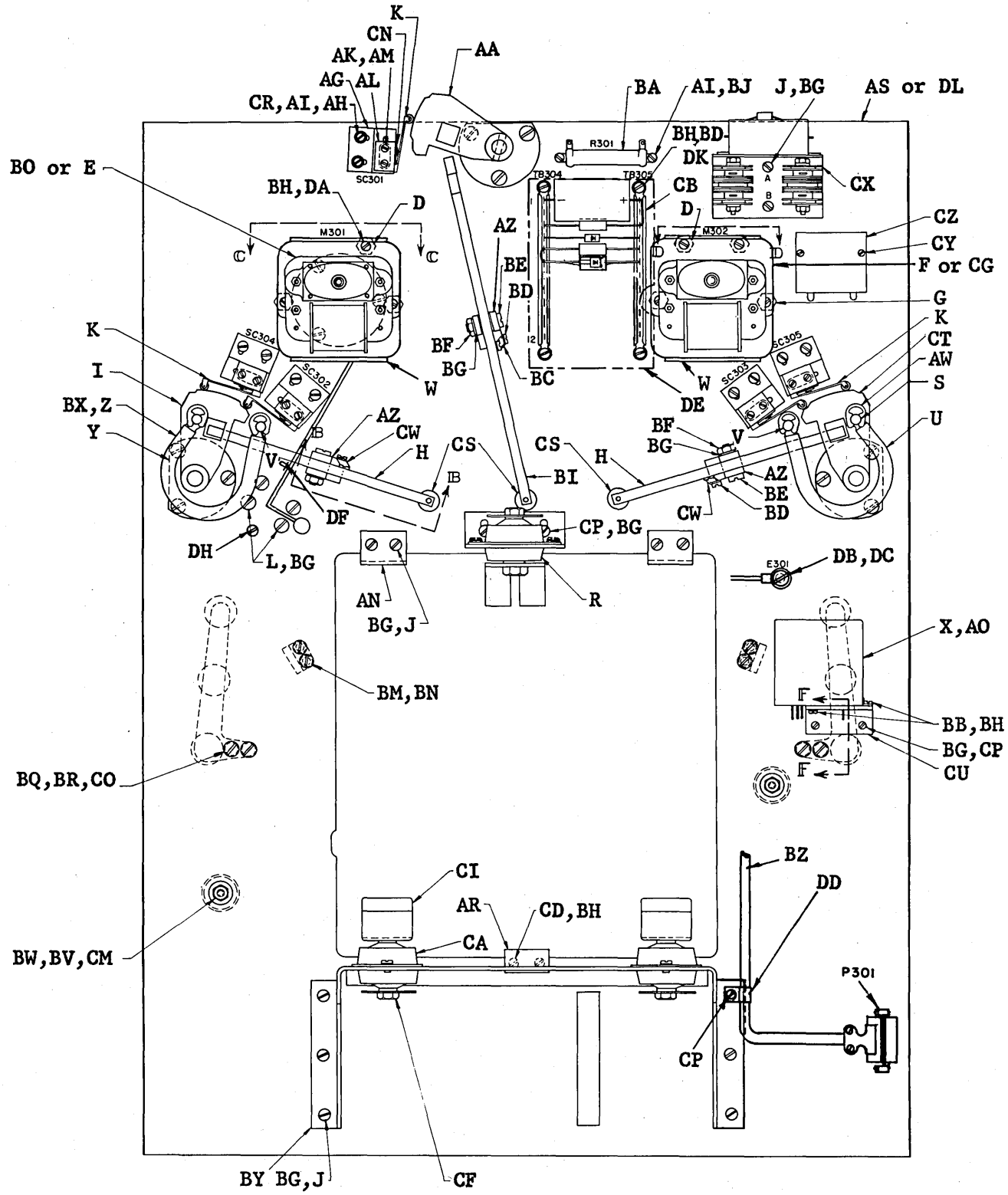


FIGURE 5-3. TAPE TRANSPORT PLATE, 371E1640 (SHEET 2 OF 3).

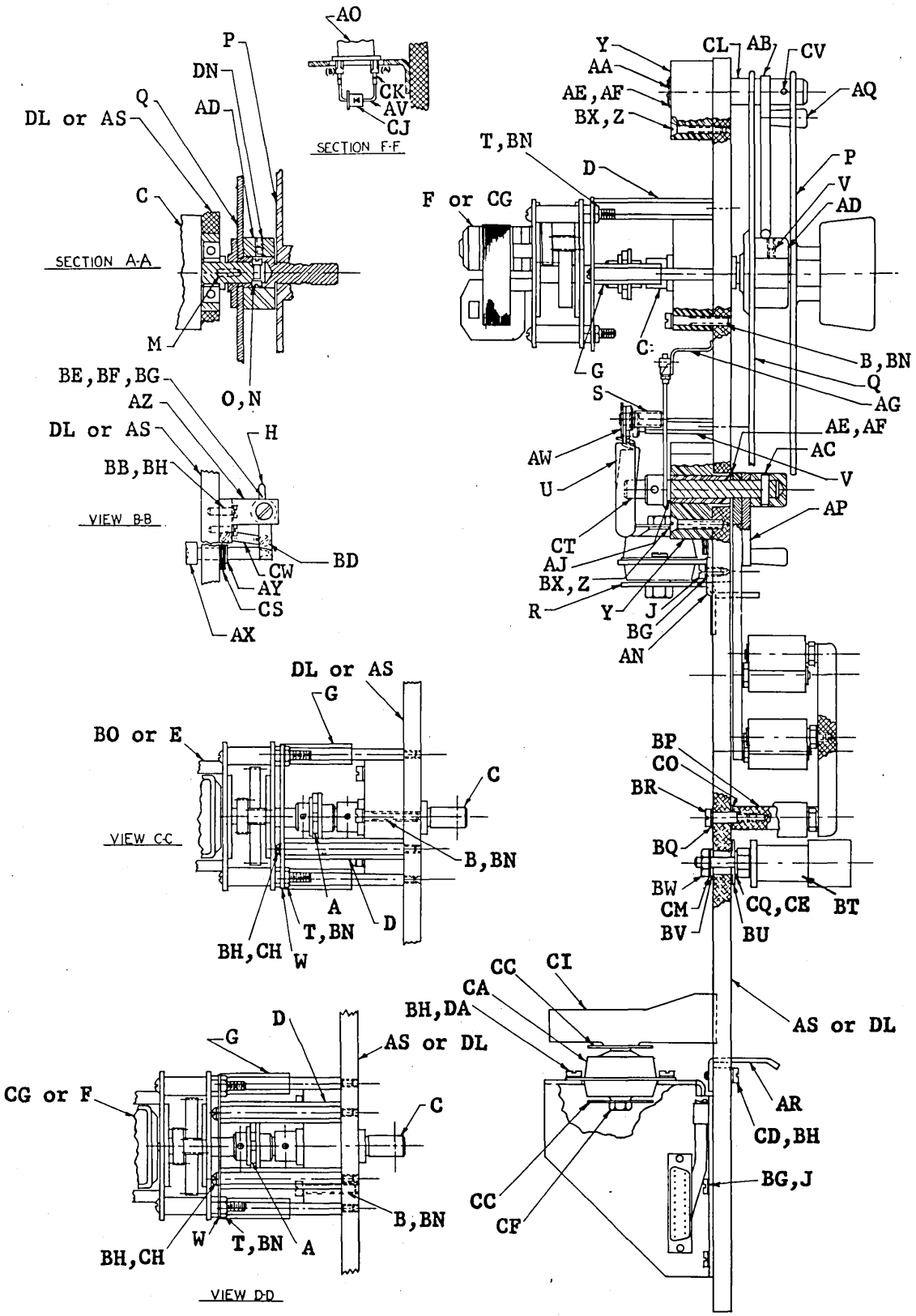


FIGURE 5-3. TAPE TRANSPORT PLATE, 371E1640 (SHEET 3 OF 3).

CONTROL ARM, RIGHT, 371A1431
PARTS LIST
FIGURE 5-4

LTR.	DRAWING NO.	PART NAME	NO. RQD.	REFS. FIG.	REFS. PAGE
A	371A1429	Arm, Control (Right)	1		
B	361A247	Handle, Control Arm	1		
C	361A270	Roll, Idler	2	5-6	5-11

CONTROL ARM, LEFT, 371A1430
PARTS LIST
FIGURE 5-5

LTR.	DRAWING NO.	PART NAME	NO. RQD.	REFS. FIG.	REFS. PAGE
A	371A1428	Arm, Control (Left)	1		
B	361A247	Handle, Control Arm	1		
C	361A270	Roll, Idler	2	5-6	5-11

IDLER ROLL, 361A270
PARTS LIST
FIGURE 5-6

LTR.	DRAWING NO.	PART NAME	NO. RQD.	REFS. FIG.	REFS. PAGE
A	361A112	Stud, Idler Roll	1		
B	361A656	Roll, Idler	1		
C	97A17790	Bearing, Paper Roll	2		
D	97A12710	Clip, Stud, C-97	1		
E	21A14531	Washer	A.R.		
F	21A14532	Washer	A.R.		
G	21A14533	Washer	A.R.		

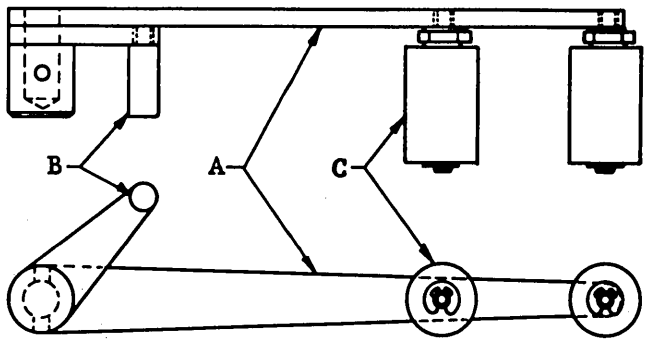


FIGURE 5-4. CONTROL ARM, RIGHT, 371A1431.

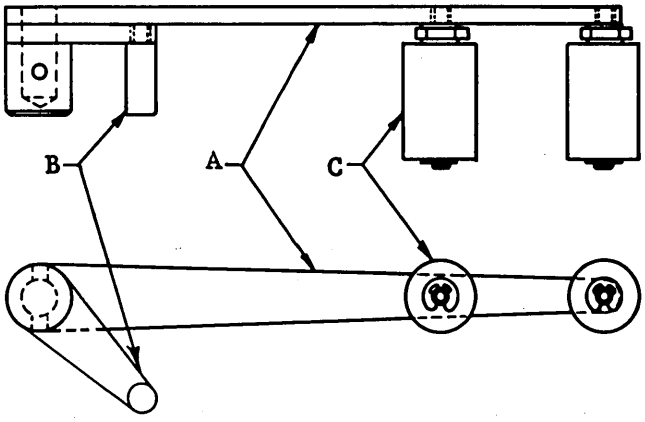


FIGURE 5-5. CONTROL ARM, LEFT, 371A1430.

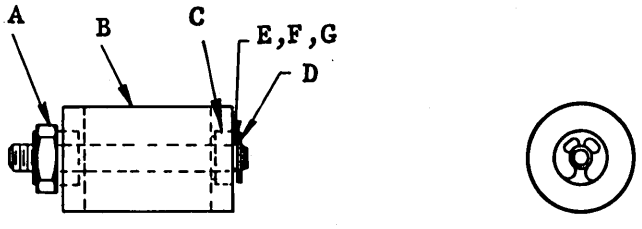


FIGURE 5-6. IDLER ROLL, 371A270.

SUPPLY REEL LINE, 371B1578
PARTS LIST
FIGURE 5-7

LTR.	DRAWING NO.	PART NAME	NO. RQD.	REFS. FIG.	REFS. PAGE
A	371A1577	Shaft, Supply Reel	1		
B	61A7427	Spacer, Indicator Segment Arm	1		
C	2A2163	Spacer, C-200 Counter Gear #1	1		
D	361A140	Housing, Supply Reel Bearing	1		
E	360A122	Bearing, Capstan	2		
F	97A15675	Pin, Spring (.156 x 3/4)	2		
G	450A9196	Plate, Coupling	1		

ADJUSTABLE IDLER ROLL, 371A1549
PARTS LIST
FIGURE 5-8

LTR.	DRAWING NO.	PART NAME	NO. RQD.	REFS. FIG.	REFS. PAGE
A	371A1550	Stud, Roll	1		
B	371A1543	Core, Roll	1		
C	5005003	Bearing, Ball Chrome #3 Grade	1		
D	1A1190	Spring, Feed Roll	1		
E	371A1545	Sleeve, Roll	1		
F	97A17790	Bearing, Paper Roll	2		
G	5005004	Bearing, Ball Carbon Steel	1		
H	61A9172	Washer, Operating Arm	1		
J	371A1544	Cap, End	1		
K	21A14531	Washer	A.R.		
L	21A14532	Washer	A.R.		
M	21A14533	Washer	A.R.		
N	97A12710	Clip, Stud	1		
P	97A18275	Screw, F. H. (2-56 x 1/4)	3		

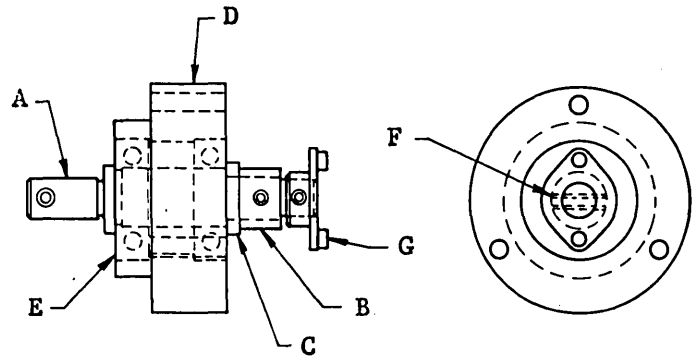


FIGURE 5-7. SUPPLY REEL LINE, 371B1578.

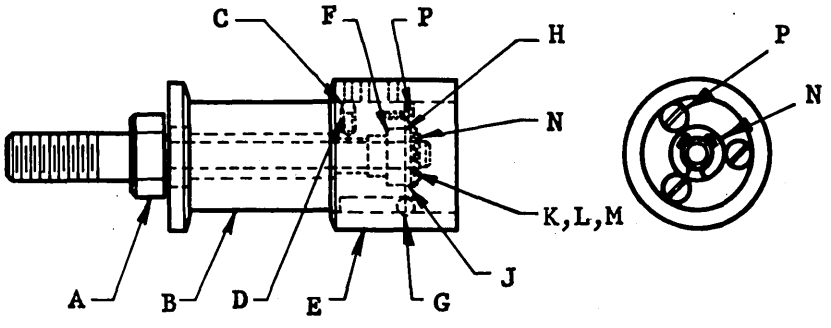


FIGURE 5-8. ADJUSTABLE IDLER ROLL, 371A1549.

SUPPRESSOR, 371B1666
PARTS LIST
FIGURE 5-9

LTR.	DRAWING NO.	PART NAME	NO. RQD.	REFS. FIG.	REFS. PAGE
A	371A1595	Bracket, Suppressor	1		
B	P5403010	Suppressor, Spark C-90	2		
C	Purchase	Washer, Int. Toothed Lock (#1208)	2		
D	421A2269	Nut, Hex (8-32 x 11/32 x 1/8)	2		
E	PA4060014	Capacitor, (304) C-90	1		
F	LB6020072	Resistor, Composition (305) C-90	1		
G	461A270	Strip, Terminal (90A72646)	1		
H	Purchase	Washer, Int. Toothed Lock (#1206)	2		
I	97A19717	Screw, P. H. Machine (6-32 x 1/4)	2		

D. C. BRAKE CHART, 371B1632
PARTS LIST
FIGURE 5-10

LTR.	DRAWING NO.	PART NAME	NO. RQD.	REFS. FIG.	REFS. PAGE
A	90A72604	Capacitor, Electrolytic	1		
B	PA6400024	Diode	2		
C	L6020207	Resistor, Composition	2		
D	L6020219	Resistor, Composition	1		
E	29A3966	Strip, Terminal	2		

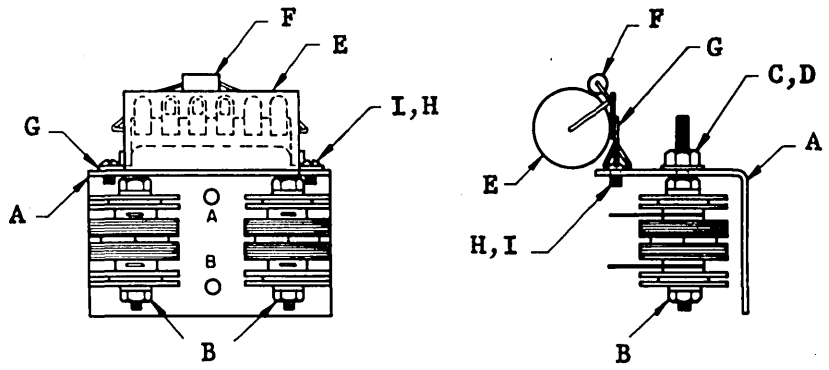


FIGURE 5-9. SUPRESSOR, 371B1666.

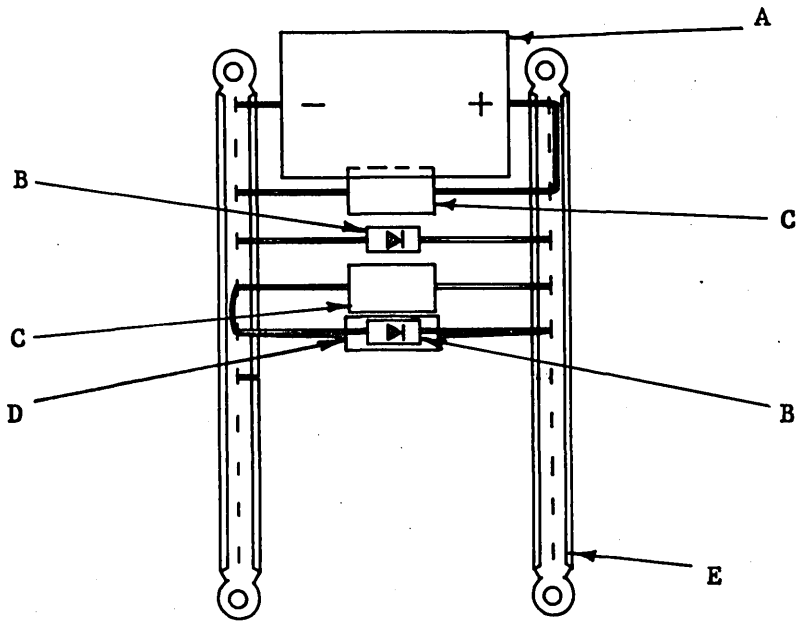


FIGURE 5-10. DC BRAKE CHART, 371B1632.

MOTOR CHART, 371B1686
PARTS LIST
FIGURE 5-11

LTR.	DRAWING NO.	PART NAME	REQ.				REFS.	
							FIG.	PAGE
A	90B5076	Motor (60 c/s Take Up)	1					
B	90B5077	Motor (60 c/s Supply)		1				
C	90B5018	Motor (50 c/s Take Up)			1			
D	90B5019	Motor (50 c/s Supply)				1		
E	97A15675	Pin, Spring (.156 x 3/4)	1	1	1	1		
F	450A9196	Plate, Coupling	1	1	1	1		

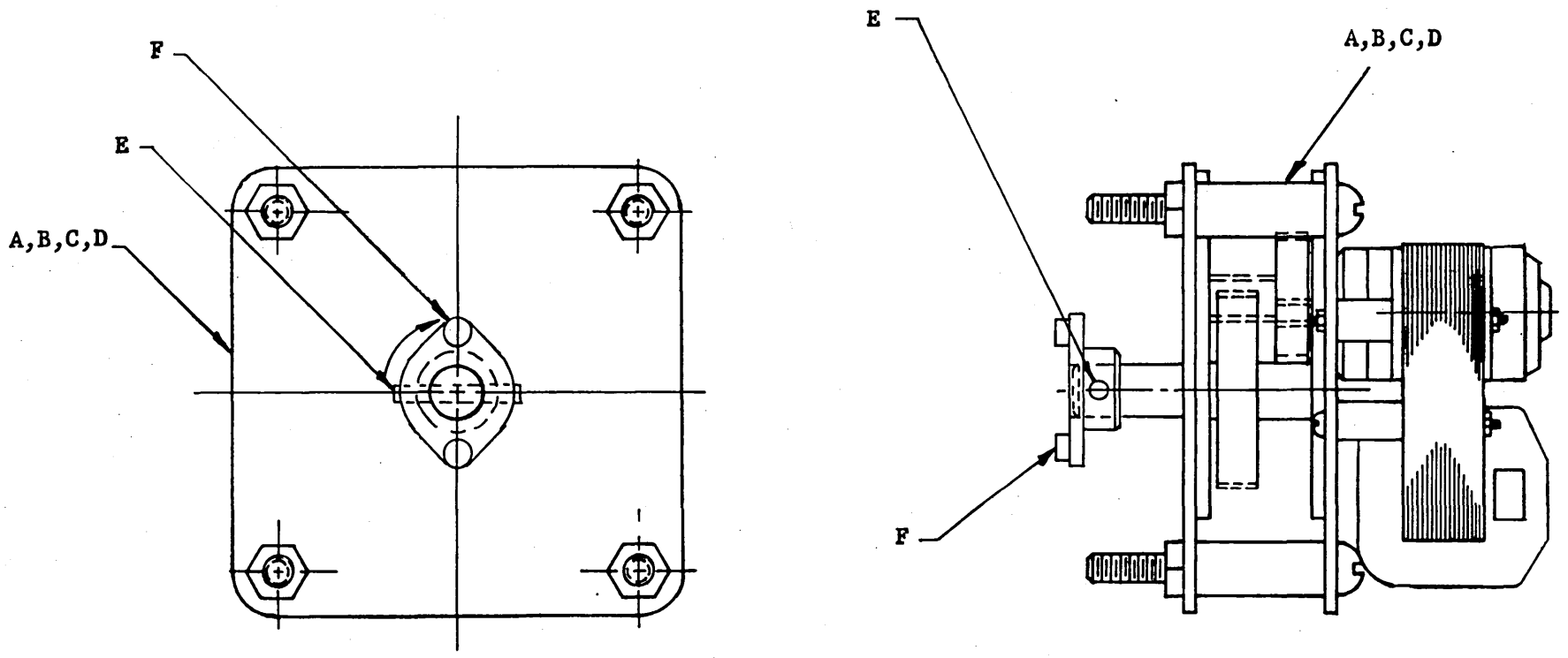


FIGURE 5-11. MOTOR CHART, 371B1686.

EM-B1 PUNCH HEAD, 371D901
PARTS LIST
FIGURE 5-12

LTR.	DRAWING NO.	PART NAME	REQ. 371X800	REQ. 371X900	REFS. FIG.	REFS. PAGE
A	371C191	Guide, Paper	1	1	5-23	5-37
B	371A162	Screw, Dowel	2	2		
C	371D546	Frame, Punch	1	1		
D	371C223	Frame, Punch Front	1	1		
E	2000A40879	Screw, Motor Support Plate	3	3		
F	800A21365	Washer, Key Cup	3	3		
G	Purchase	Washer, #10 Lock, Internal Tooth (#1210)	3	3		
H	371C232	Frame, Punch Back	1	1		
I	20A28970	Nut, Bracket Tie Rod	8	8		
J	97A17935	Screw, Pan Hd. Mach (6-32 X 3/16)	3	3		
K	Purchase	Washer, 5/16 Lock (#5440016)	8	8		
L	371B63	Line, Punch Eccentric	1	1	5-14	5-29
M	371C284	Wheel, Sprocket & Ratchet	1	1		
N	371C81	Punch and Die	1	1	5-16	5-31
O	371C17	Interposer	1	1	5-19	5-33
P	371A582	Retainer, "O" Ring	1	1		
Q	51A3332	Screw, Guide Bracket	3	3		
R	Purchase	Washer, #5 Lock Internal Tooth (#1205)	19	19		
S	371B945	Link, Armature & Magnet	1	1		
T	371C950	Magnet, Paper Feed	1	1		
U	371A129	Board, Magnet Plug	2	2		
V	371A1656	Holder, Detent Arm	1	1	5-15	5-29
W	371B865	Line, Reset	1	1	5-18	5-33
X	371A89	Lever, Punch Restoring	9	9		
Y	Purchase	Washer, #6 Lock Internal Tooth (#1206)	1	1		
Z	371A896	Arm, Feed Pawl	1	1		
AA	371A646	Mounting, Blower	1	1		
AB	371A153	Arm, Paper Tape Guide	1	1		
AC	371A135	Magnet	9	9	5-22	5-37
AD	371A195	Casting, Magnet Mounting	1	1		
AE	371A196	Casting, Magnet Mounting	1	1		
AF	371D911	Motor, Mounted	1	1	5-20	5-35
AG	371B327	Chute	1	1		
AH	371B146	Shoe, Paper Guide	1	1		
AI	371C1270	Harness, Punch Wiring	1	1		
AJ	371C794	Block, Safety Stop	1	1	5-21	5-37
AK	371A245	Spacer	1	1		
AL	1700A42417	Screw, Counter Center	1	1		
AM	97A17440	Washer, #10 Lock Internal Tooth	8	8		
AN	371A37	Screw, Magnet Unit Lock	2	2		
AO	371A36	Screw, Magnet Unit Lock	2	2		
AP	2000A118132	Screw, Check Cutter Driving Gear Guard #1	1	1		
AQ	371A41	Bracket, Micro Switch (Tape Guide)	1	1		
AR	4000A29536	Screw, Cover Hinge	2	2		
AS	371A478	Screw	2	2		

EM-B1 PUNCH HEAD, 371D901
PARTS LIST
FIGURE 5-12

LTR.	DRAWING NO.	PART NAME	REQ. 371X800	REQ. 371X900	REFS. FIG.	REFS. PAGE
AT	421A841	Insulator	2	2		
AU	421A1150	Plate, Screw	1	1		
AV	371A479	Screw	2	2		
AW	371A43	Stud, Spring	1	1		
AX	371A45	Screw, Shoe Eccentric Lock	2	2		
AY	371A46	Spacer, Guide Shoe (Left)	1	1		
AZ	371A47	Spacer, Guide Shoe (Right)	1	1		
BA	371A52	Spacer	1	1		
BB	371A69	Shaft, Punch Restoring Lever	1	1		
BC	97A8216	Nut, Hex (3/16-32 X 3/8 X 1/8)	1	1		
BE	97A12147	Clip, Stud	3	3		
BF	371A90	Bracket, Punch Restoring Lever	1	1		
BG	1200A23504	Washer, Spec. Co. Retaining Pawl	2	2		
BH	100A184512	Spacer, Selector Arm #1	1	1		
BI	371A499	Comb, Punch Lever	1	1	5-13	5-29
BJ	380A819	Spacer, Backboard	2	2		
BK	371A973	Screw, Interposer Shoulder	9	9		
BL	Purchase	Washer, #8 Lock (#5440006)	15	15		
BM	371A72	Eccentric, Magnet Adjusting	9	9		
BN	31A35446	Screw, Solenoid Plunger	2	2		
BO	371A75	Screw, Magnet Locking	18	18		
BP	371A243	Lever, Punch	9	9		
BQ	371A103	Pawl, Feed (New Tape Feed)	1	1		
BR	371A106	Eccentric, Magnet Adjusting	1	1		
BS	371A109	Eccentric, Detent Adjusting Bracket	1	1		
BT	371A120	Hook, Restoring Arm Spring	1	1		
BU	371A1279	Spring	9	9		
BV	371A147	Arm, Pressure	1	1		
BW	371A149	Spring, Torsion	1	1		
BX	97A14969	Clip, Stud	1	1		
BY	371A150	Knob, Paper Shoe	1	1		
BZ	371A158	Plate, Bearing Retainer	1	1		
CA	2000A48364	Screw, Data Wheel	3	3		
CB	371A176	Plate, Bearing Retainer	1	1		
CC	800A93659	Screw, Index Type Segt. Hub	9	9		
CD	Purchase	Washer, #3 Lock Internal Tooth (#1203)	3	3		
CE	371A177	Plate, Bearing Retainer	1	1		
CF	371A183	Stud, Motor	4	4		
CG	371A1641	Label, Special	1	1		
CH	371A185	Spring	1	1		
CI	371A434	Arm, Feed Pawl Actuating	1	1		
CJ	371A485	Holder, Magnet Pickup	2	2		
CK	2000A37702	Screw, Spiral Pinion Bracket Dowel #1	4	4		
CL	Pruchase	Wacher, #12 Lock (#5440009)	2	2		
CM	90A72756	Block, Terminal (Chart #90A72631)	1	1		
CN	371A487	Plug, Timing	2	2		

EM-B1 PUNCH HEAD, 371D901
PARTS LIST
FIGURE 5-12

LTR.	DRAWING NO.	PART NAME	REQ. 371X800	REQ. 371X900	REFS. FIG.	REFS. PAGE
CO	371A137	Pickup, Electro Magnetic	2	2		
CP	97A18381	Screw, Set	2	2		
CR	371A903	Clamp, Feed Magnet	1	1		
CS	97A21817	Screw, F. H. (#6-32 X 3/4)	1	1		
CT	371A932	Angle, Mounting	1	1		
CU	A118017	Washer, Carriage Roll #1	2	2		
CV	Purchase	Washer, #2 Lock Internal Tooth (#1202)	8	8		
CX	371A933	Retainer, Armature	1	1		
CY	371A934	Clip, Spring	1	1		
CZ	371A1252	Spring, Feed Magnet	1	1		
DA	2000A8184	Screw, Special Counter Dowel #1	8	8		
DB	371A949	Shim (.005)	A.R.	A.R.		
DB	371A620	Shim (.002)	A.R.	A.R.		
DB	371A621	Shim (.003)	A.R.	A.R.		
DC	2000A40971	Screw, Engaging Spider Hub Dowel #1	2	2		
DD	1800A75534	Screw, Slip Table Stop	1	1		
DE	371A675	Insulator, Flat	1	1		
DF	371B49	Hub, Bearing	1	1		
DG	371B589	Link, Paper Tape Guide Arm	1	1		
DH	371C832	Frame, Sprocket	1	1		
DI	97A26198	Bearing, Ball	1	1		
DJ	97B16943	Bearing, Interposer Cam Line	3	3		
DK	97A16945	Ring, Snap	1	1		
DL	97A16954	Ring, Snap	1	1		
DM	97A18379	Screw, Socket Head	1	1		
DN	Purchase	Washer, #10 Lock (#5440008)	3	3		
DO	2000A75536	Screw, Tot. Level Handle	2	2		
DP	371B1201	Gear, Motor	1	-		
DQ	90A72518	Washer, "D"	1	1		
DR	90A72551	Actuator	1	1		
DS	Purchase	Washer, #7 Lock (#1207-01)	4	4		
DT	97B16955	Bearing, Eccentric Shaft	2	2		
DU	PA4758013	Clip, Cable	1	1		
DV	97A17845	Screw, Pan Head (6-32 X 3/8)	1	1		
DW	97A15553	Nut, Hex. (10-32 X 3/8 X 5/64)	2	2		
DX	97A12642	Clip, Stud	1	1		
DY	97A15599	Nut, Hex. (6-32 X 5/16 X 7/64)	1	1		
DZ	97A12710	Clip, Stud	1	1		
EA	LA6710605	Block, Terminal (Chart #LA6710600)	1	1		
EB	371B1204	Gear, Motor	-	1		
EC	371A255	Guide, Paper	1	1		
ED	97A16958	Screw, Hex. Socket Set	1	1		
EE	900A67	Washer, Type Wheel Segment Oper. Arm	4	4		
EF	900A94021	Screw, Imp. Block Guide Arm Zinc Coated	8	8		
EG	97A21822	Screw, Socket Set (6-32)	1	1		
EH	371B630	Guide, Paper Tape	1	1		

EM-B1 PUNCH HEAD, 371D901
PARTS LIST
FIGURE 5-12

LTR.	DRAWING NO.	PART NAME	REQ. 371X800	REQ. 371X900	REFS. FIG.	REFS. PAGE
EJ	152703	Screw, Knob #1	2	2		
EK	PA4744015	Lock, Screw	2	2		
EL	97A3997	Plate, Factory Number #4	1	1		
EM	371A469	Blower	1	1		
EN	371A481	Screw	3	3		
EO	371A619	Spacer, Ratchet Wheel	A.R.	A.R.		
EP	371A622	Spacer, Ratchet Wheel	A.R.	A.R.		
EQ	371A623	Spacer, Ratchet Wheel	A.R.	A.R.		
ER	371A1657	Stud, Eccentric	1	1		
ES	371A1658	Spring, Detent	1	1		
ET	371B48	Shaft, Sprocket	1	1		
EU	Purchase	Washer, #10 Lock (#5440007)	1	1		
EV	97A22672	Nut, Hex. (10-32 X 3/8 X 1/8)	1	1		
EW	371X671	Washer, Spacing (Chart 371A674) .002 in. Thick	A.R.	A.R.		
EX	371X672	Washer, Spacing (Chart 371A674) .003 in. Thick	A.R.	A.R.		
EY	371X673	Washer, Spacing (Chart 371A674) .005 in. Thick	A.R.	A.R.		

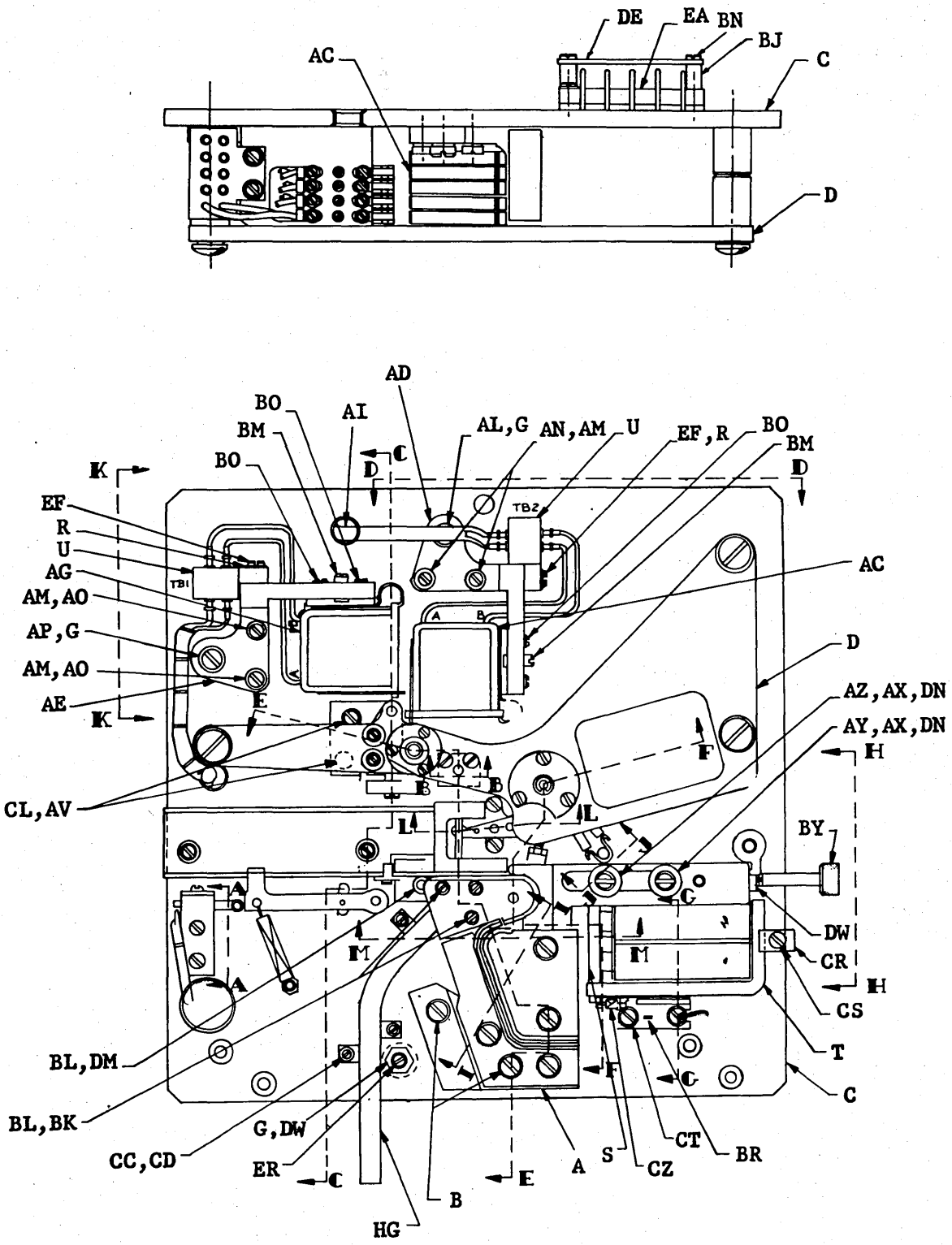


FIGURE 5-12. EM-B1 PUNCH HEAD, 371D901 (SHEET 1 OF 6).

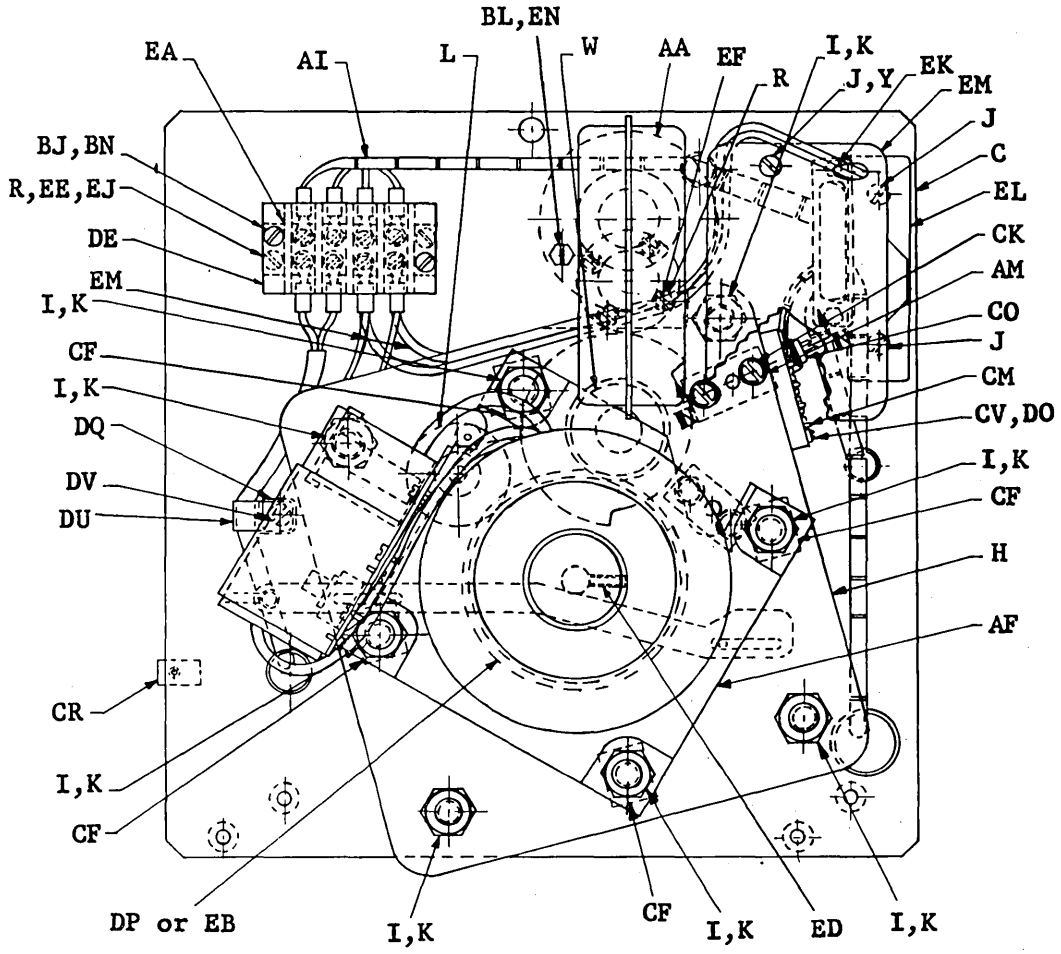


FIGURE 5-12. EM-B1 PUNCH HEAD, 371D901 (SHEET 2 OF 6).

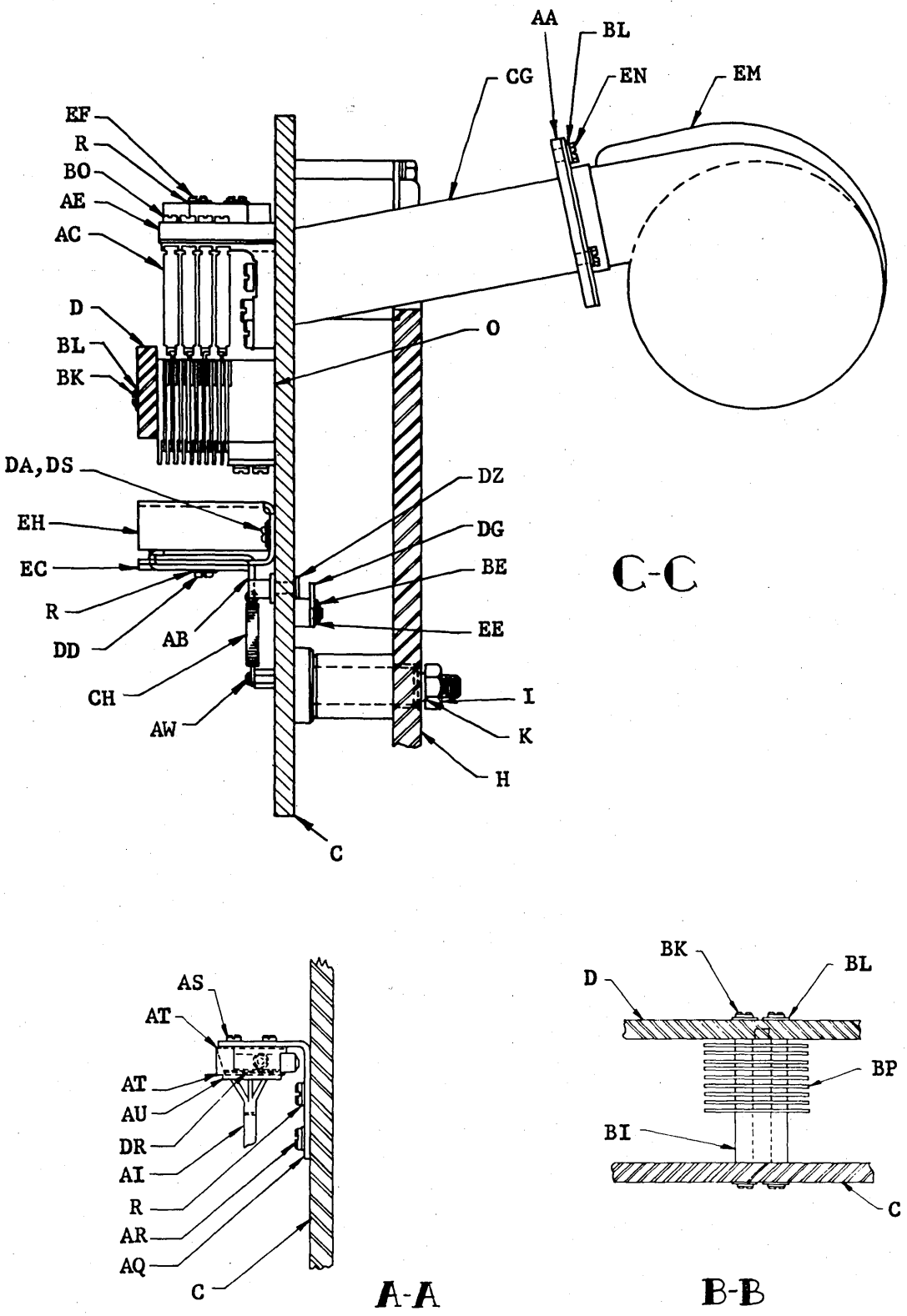
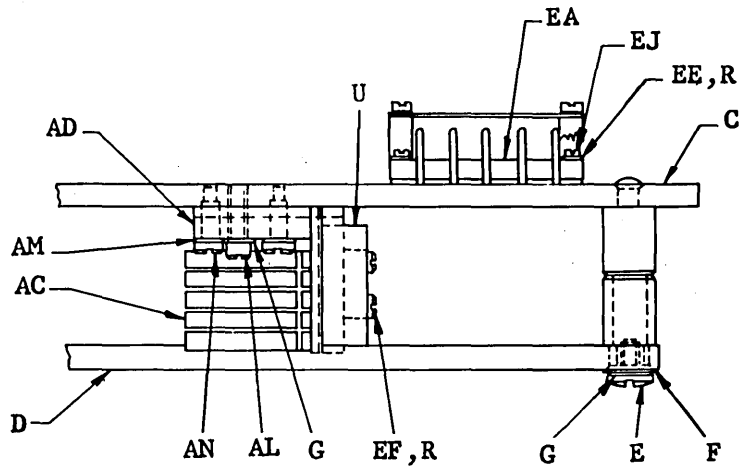
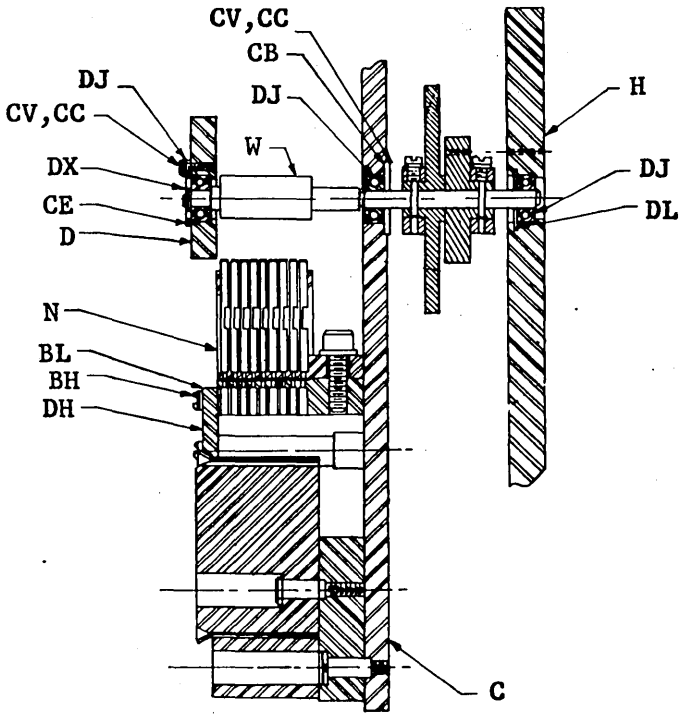


FIGURE 5-12. EM-B1 PUNCH HEAD, 371D901 (SHEET 3 OF 6).



SECTION D-D



SECTION E-E

FIGURE 5-12. EM-B1 PUNCH HEAD, 371D901 (SHEET 4 OF 6).

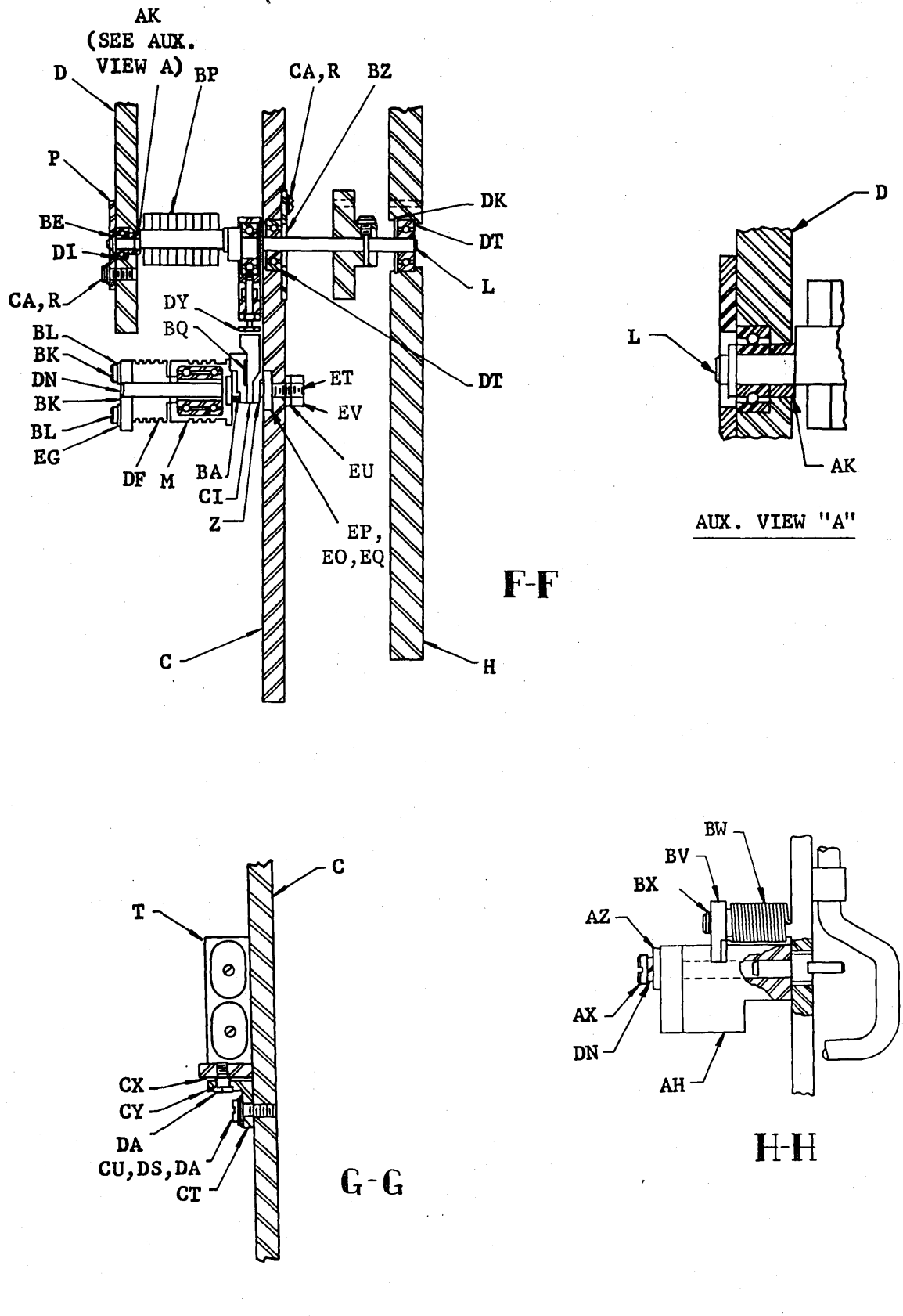


FIGURE 5-12. EM-B1 PUNCH HEAD, 371D901 (SHEET 5 OF 6).

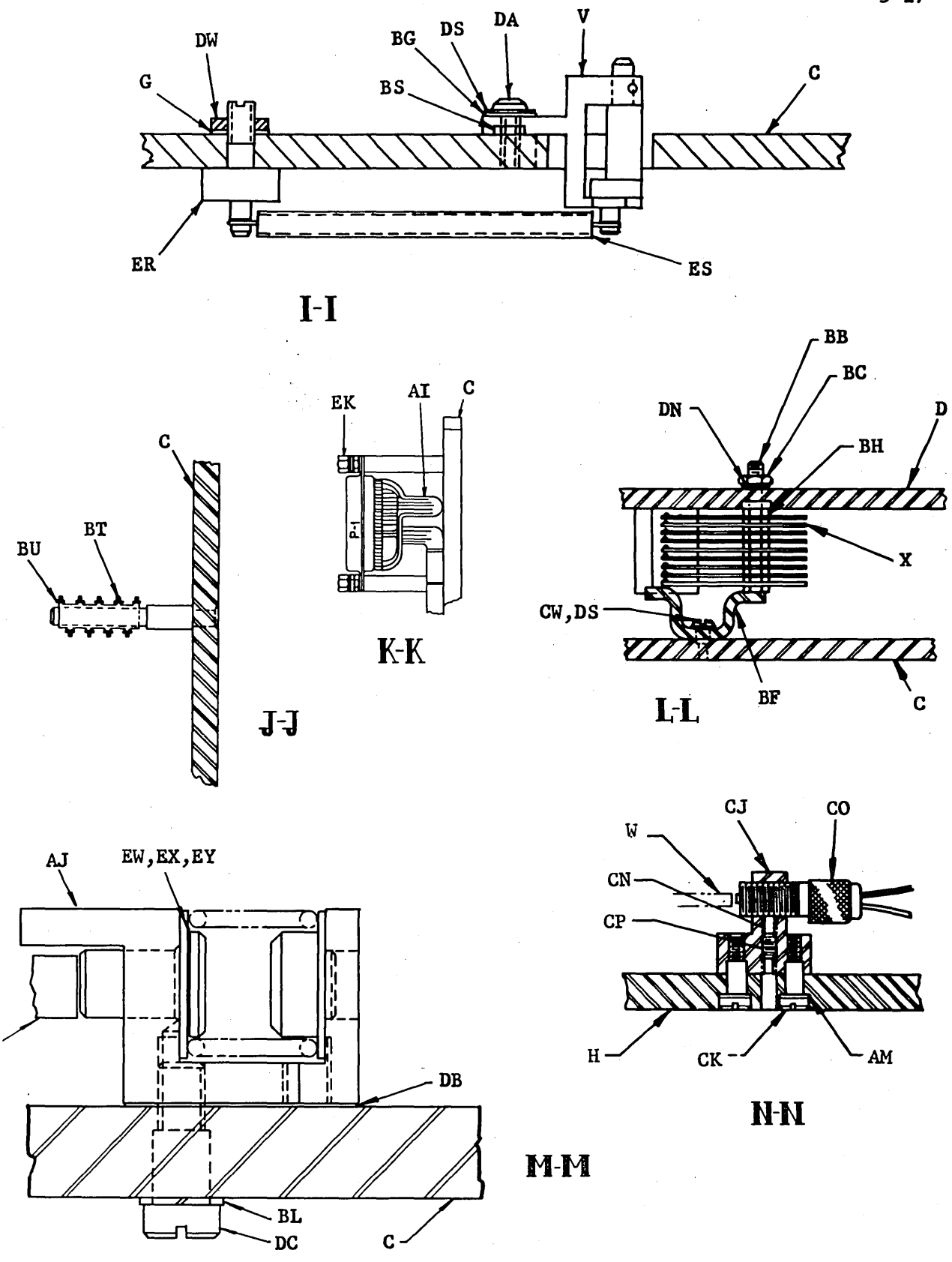


FIGURE 5-12. EM-B1 PUNCH HEAD, 371D901 (SHEET 6 OF 6).

PUNCH LEVER COMB, 371A499
PARTS LIST
FIGURE 5-13

LTR.	DRAWING NO.	PART NAME	NO. RQD.	REFS. FIG.	REFS. PAGE
A	371B71	Comb, Punch Lever	1		
B	371A74	Shaft, Punch Lever Pivot	1		
C	2000A237055	Wick, Oil Cup #2	A.R.		
D	97A20872	Pin, Roll	5		

PUNCH ECCENTRIC LINE, 371B63
PARTS LIST
FIGURE 5-14

LTR.	DRAWING NO.	PART NAME	NO. RQD.	REFS. FIG.	REFS. PAGE
A	371B867	Line, Punch Eccentric	1		
B	371A429	Housing, Feed Pawl Bearing	1		
C	371A118	Ring, Snap	1		
D	97A18373	Ring, Retaining	1		
E	97B16942	Bearing, Paper Feed Eccentric	1		

DETENT ARM HOLDER, 371A1656
PARTS LIST
FIGURE 5-15

LTR.	DRAWING NO.	PART NAME	NO. RQD.	REFS. FIG.	REFS. PAGE
A	371B461	Holder, Detent Arm	1		
B	371A1654	Shaft, Detent Arm	1		
C	371A1680	Arm, Detent	1		
D	97B19340	Pin, Taper #62	1		

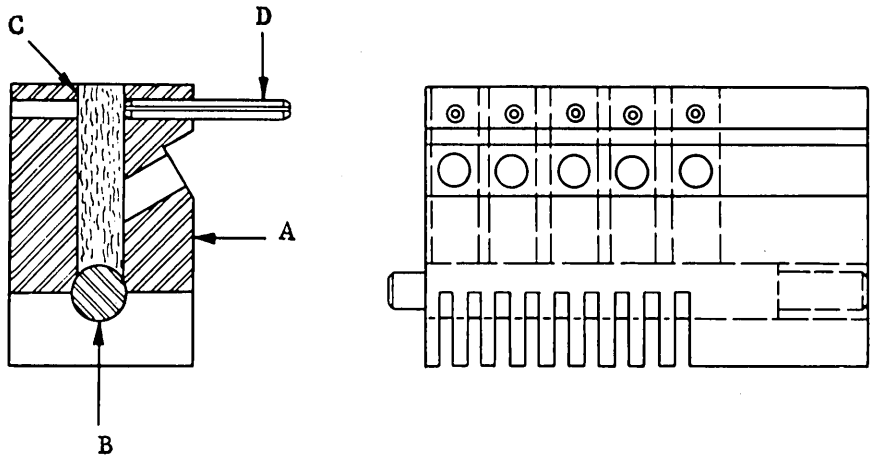


FIGURE 5-13. PUNCH LEVER COMB, 371A499.

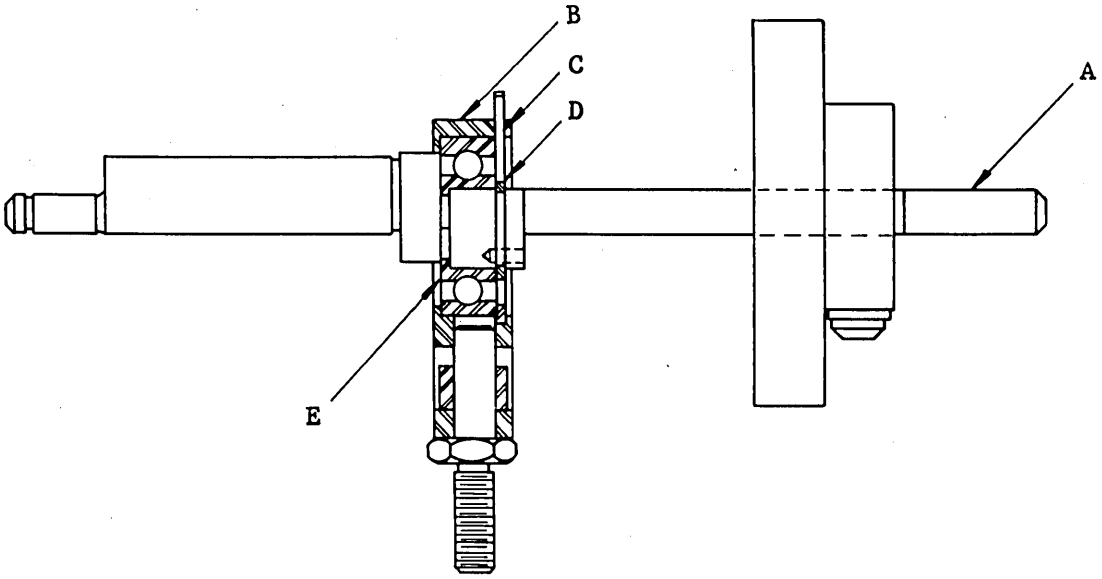


FIGURE 5-14. PUNCH ECCENTRIC LINE, 371B63.

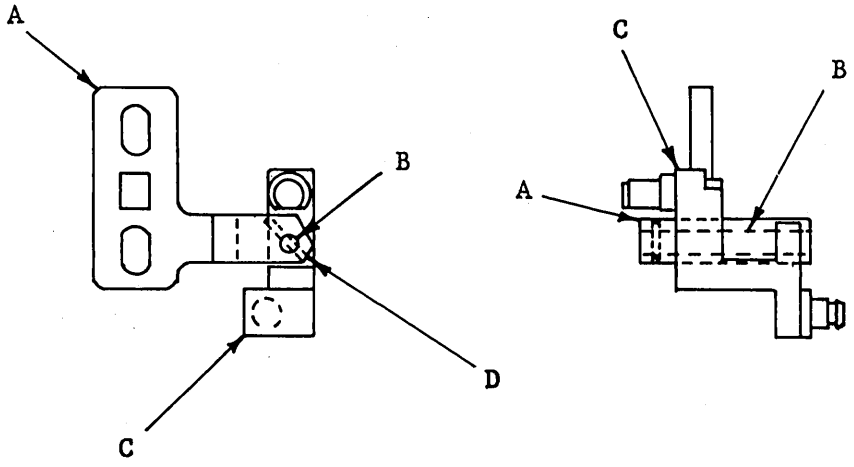


FIGURE 5-15. DETENT ARM HOLDER, 371A1656.

PUNCH AND DIE, 371C81
PARTS LIST
FIGURE 5-16

LTR.	DRAWING NO.	PART NAME	NO. RQD.	REFS. FIG.	REFS. PAGE
A	See Chart Fig. 5-16	Pin, Punch (Code)	8		
B	See Chart Fig. 5-16	Pin, Punch (Sprocket)	1		
*C	371C82	Block, Die	1		
*D	371C83	Block, Punch Guide	1		
E	97A18360	Screw, Socket Head	1		
F	97A16947	Pin, Die Block Dowel	2		
G	5440008	Washer, #10 Lock (#5440008)	1		
		*Items C and D must be ordered as a matched pair.			

INTERPOSER GUIDE COMB, 371B1250
PARTS LIST
FIGURE 5-17

LTR.	DRAWING NO.	PART NAME	NO. RQD.	REFS. FIG.	REFS. PAGE
A	371B26	Comb, Interposer Guide	1		
B	371A1246	Rivet	1		
C	371A1247	Block, Interposer Stop	1		
D	371A1248	Rivet	2		

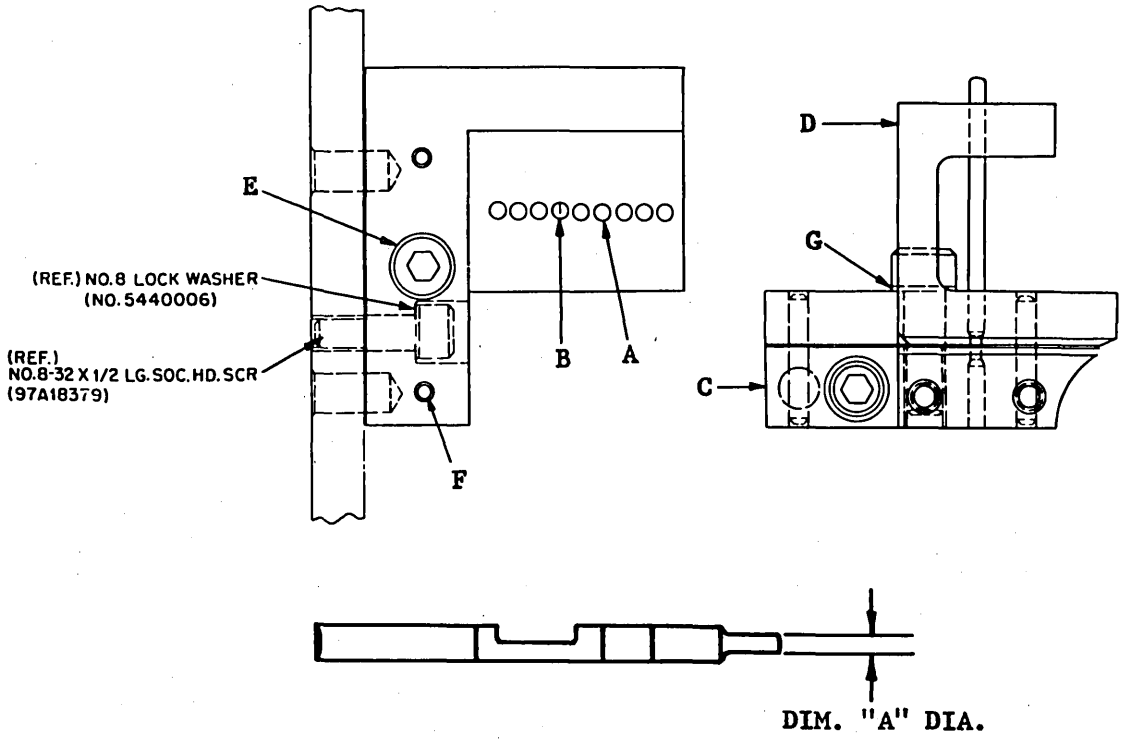


CHART A
371A935

PART NO.	PUNCH DIA. DIM. "A"
371X938	BLANK
371X936	.0728-.0730
371X93	.0731-.0733
371X937	.0725-.0727

CHART B
371A960

PART NO.	PUNCH DIA. DIM. "A"
371X963	BLANK
371X96	.0471-.0473
371X961	.0468-.0470
371X962	.0465-.0467

FIGURE 5-16. PUNCH AND DIE, 371C81.

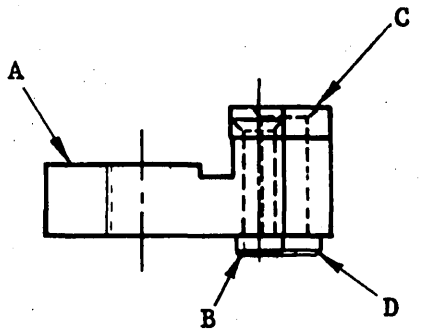


FIGURE 5-17. INTERPOSER GUIDE COMB, 371B1250.

RESET LINE, 371B865
PARTS LIST
FIGURE 5-18

LTR.	DRAWING NO.	PART NAME	NO. RQD.	REFS. FIG.	REFS. PAGE
A	371B155	Shaft, Interposer Restoring Cam	1		
B	371B455	Disc, Timing	1		
C	371A140	Collar	2		
D	371B798	Pinion, Punch Drive	1		
E	5440001	Washer, #4 Lock	2		
F	371A139	Screw, Pilot	2		

INTERPOSER, 371C17
PARTS LIST
FIGURE 5-19

LTR.	DRAWING NO.	PART NAME	NO. RQD.	REFS. FIG.	REFS. PAGE
B	371C18	Block, Punch Interposer Guide	1		
C	371A19	Shaft, Punch Interposer Arm	1		
D	371B616	Block, Stop	1		
E	371A21	Arm, Punch Interposer Operating (1-3-5-7-9)	5		
F	371A23	Arm, Punch Interposer Operating (2-4-6-8)	4		
G	371A24	Pin, Interposer	9		
H	371A25	Interposer, Punch	9		
I	371B1250	Comb, Interposer Guide	1	5-17	5-31
J	371A973	Screw, Interposer Shoulder	2		
L	97A15594	Screw, Pan Head (#8-32 x 1/4)	2		
M	5440006	Washer, #8 Lock	2		
N	371A1258	Spring, Punch Interposer Arm (Horiz.)	5		
O	371A1257	Spring, Punch Interposer Arm (Vert.)	4		
P	5441007	Washer, #8 Internal Tooth Lock	2		
Q	371A617	Shim, (.003)	A.R.		
R	371A618	Shim, (.005)	A.R.		

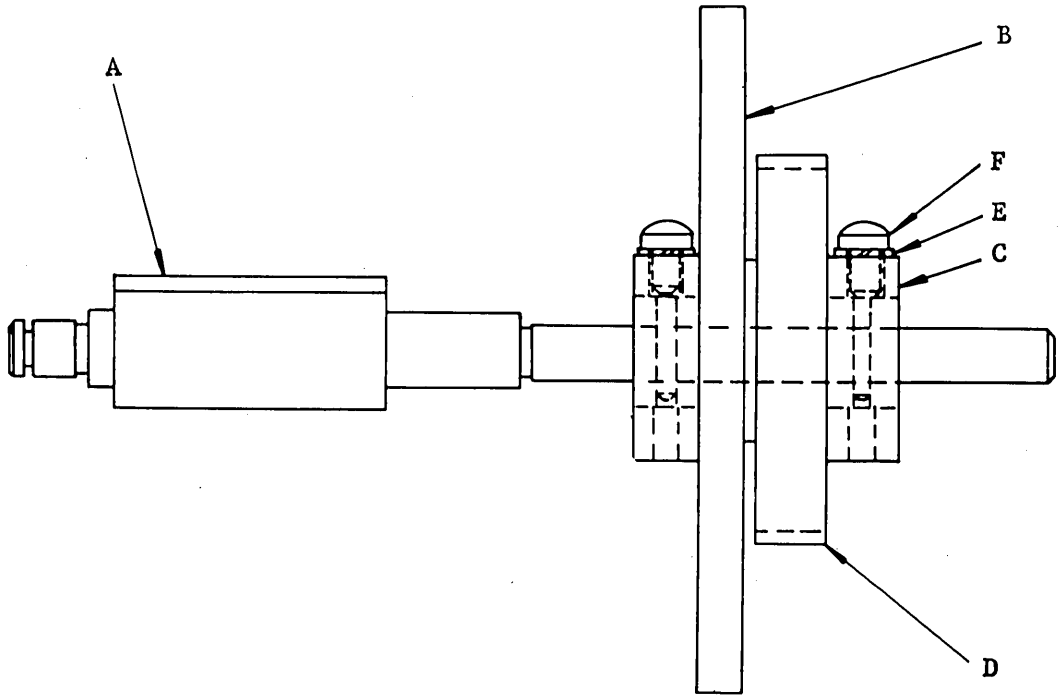


FIGURE 5-18. RESET LINE, 371B865.

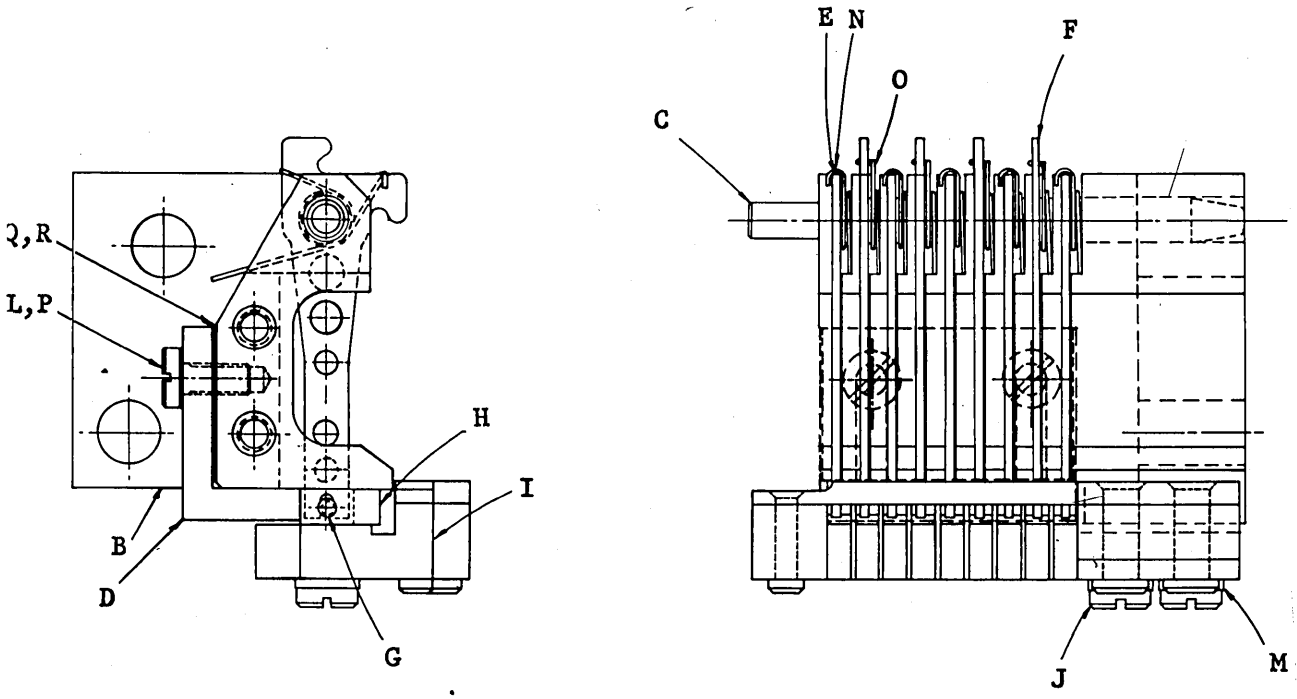


FIGURE 5-19. INTERPOSER, 371C17.

MOUNTED MOTOR, 371D911
PARTS LIST
FIGURE 5-20

LTR.	DRAWING NO.	PART NAME	NO. RQD.	REFS. FIG.	REFS. PAGE
A	371B498	Plate, Motor Mounting	1		
B	PB6300029	Motor	1		
C	371A517	Plate, Motor Component	1		
D	PA4072011	Capacitor, AC	1		
E	31A30478	Bracket, Motor Capacitor	1		
F	97A20815	Screw, Pan Head (6-32 x 1/2)	4		
G	PA4370008	Breaker, Thermal Circuit	1		
H	97A19744	Screw (10-32 x 5/16)	2		
J	371A690	Holder, Relay	1		
K	PA5980004	Relay, Motor Starting	1		
L	97A9115	Nut, Hex (6-32 x 1/4 x 3/32)	4		
M	Purchase	Washer, External Tooth Lock (#1106-00)	4		
N	Purchase	Washer, Internal Tooth Lock (#1210-06) (#5441008)	2		
O	Purchase	Screw, Socket Head Cap (8-32 x 1/2) 5456005	4		
R	371A727	Insulator	1		
S	97A18359	Washer, Fiber	4		
V	Purchase	Washer, #8 Lock (5440005)	4		
W	LB478007	Tubing, Insulating (Chart LB4780000)	2		
X	LB5830020	Wire, Insulated (Chart LB5830000)	2		
Y	PA6730003	Terminal, Wire (AI)	2		
Z	Purchase	Washer, External Tooth Lock 5441022	2		
AA	97A15534	Nut, Hex (2-56 x 3/16 x .0625)	2		
AB	421A1300	Screw (2-56 x 1/4)	2		
AC	371A676	Insulator, Motor Start Relay	1		

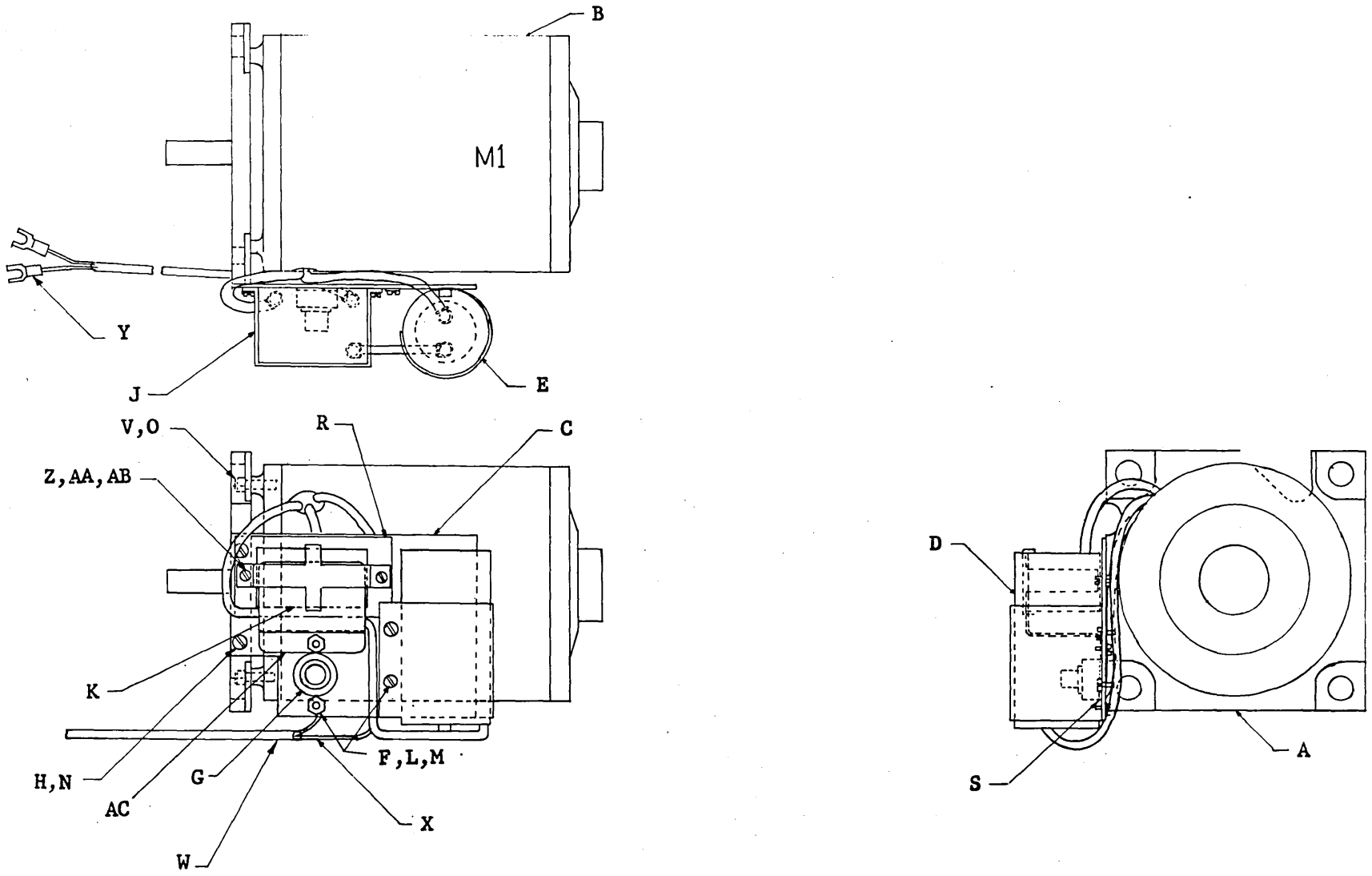


FIGURE 5-20. MOUNTED MOTOR, 371D911.

SAFETY STOP BLOCK, 371C794
PARTS LIST
FIGURE 5-21

LTR.	DRAWING NO.	PART NAME	NO. RQD.	REFS. FIG.	REFS. PAGE
A	371B789	Block, Safety Stop	1		
B	371A984	Spring	1		
C	371A985	Plunger, Spring	1		
D	371A986	Button, Spring	1		

MAGNET, 371A135
PARTS LIST
FIGURE 5-22

LTR.	DRAWING NO.	PART NAME	NO. RQD.	REFS. FIG.	REFS. PAGE
A	371A27	Armature	1		
B	371A40	Retainer, Armature	1		
C	371A94	Retainer, Armature	1		
D	2000A59769	Screw, Key Frame Lock Plunger Retainer #1	2		
E	371A145	Plate, Magnet Adjusting	1		
F	30A7574	Screw, Compression Roll Shaft Brace	2		
G	371A39	Strip, Armature Stop	1		
H	371A133	Frame, Magnet	1		
I	5441001	Washer, #2 Lock	2		

PAPER GUIDE, 371C191
PARTS LIST
FIGURE 5-23

LTR.	DRAWING NO.	PART NAME	NO. RQD.	REFS. FIG.	REFS. PAGE
A	371B194	Base, Paper Guide	1		
B	371C193	Block, Paper Guide	1		
C	371C544	Frame, Paper Guide	1		
D	371A162	Screw, Dowel	4		
E	Purchase	Washer, #10 Lock, 1210-06	4		

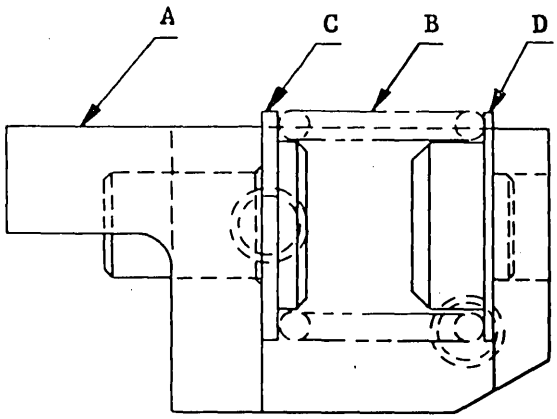


FIGURE 5-21. SAFETY STOP BLOCK, 371C794.

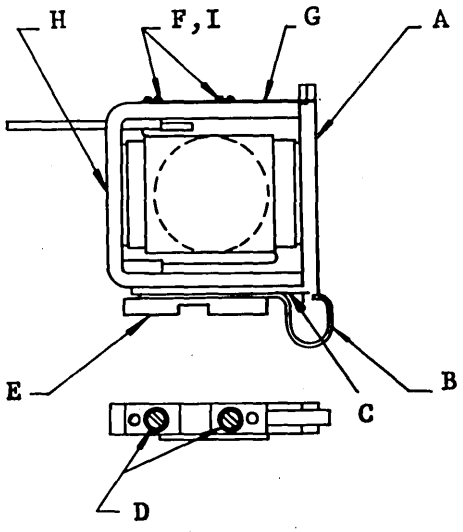


FIGURE 5-22. MAGNET, 371A135.

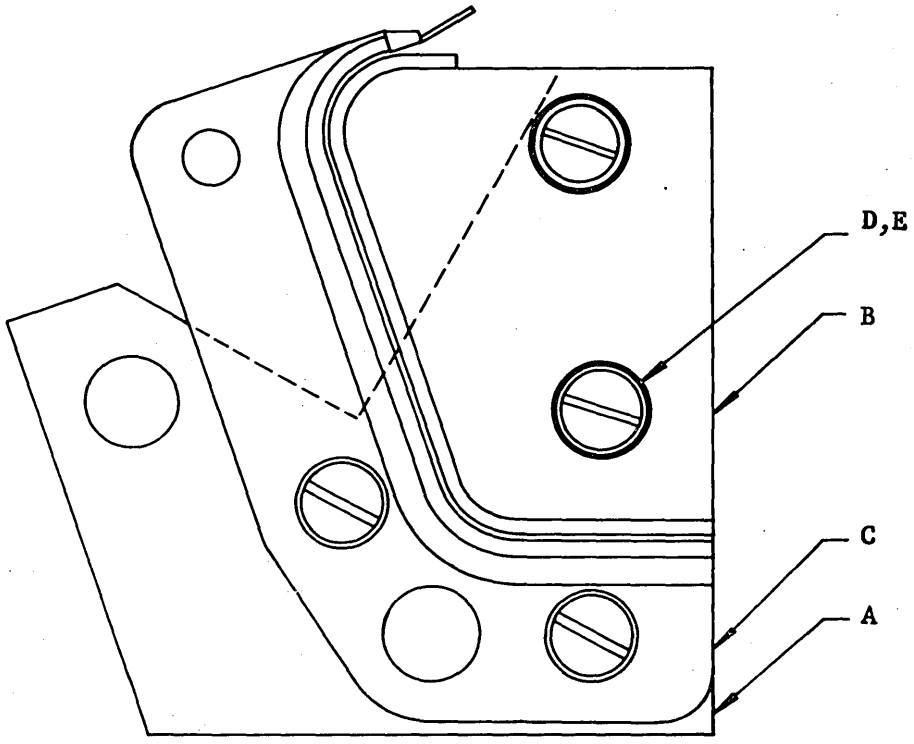
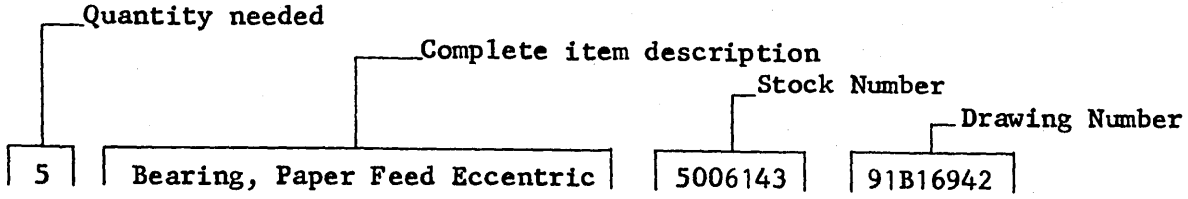


FIGURE 5-23. PAPER GUIDE, 371C191.

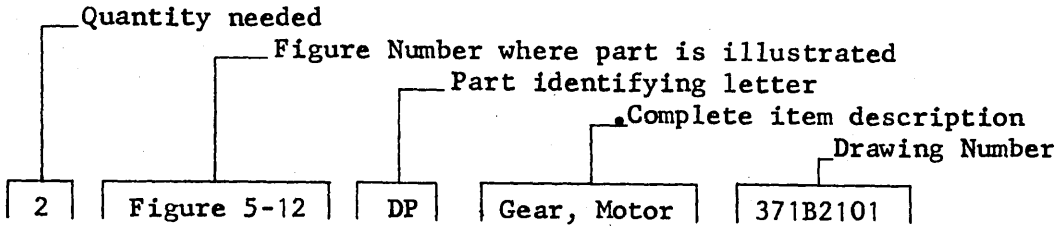
ORDERING INFORMATION - PARTS

The following procedure must be followed when ordering parts for the EM-B2 Paper Tape Punch.

1. When ordering parts listed in the NCR Recommended Spare Part List, include the following information on the purchase order.



2. When ordering parts not listed in the NCR Recommended Spare Parts List, include the following information on the purchase order.



ORDERING INFORMATION - DRAWINGS

When ordering drawings of the EM-B2 Paper Tape Punch the drawing number is all that is required.

RECOMMENDED SPARE PARTS
TAPE TRANSPORT

DEP. QTY.	SITE QTY.	DESCRIPTION	STOCK NO.	DRAWING NO.
3	1	Actuator	3790026	PA4765026
1		Capacitor	3210017	90A72604
1		Diode	3110040	PA6400024
1		Diode	3110060	PA6400035
1	1	Reel, Tape	361A599	361A599
1		Roll, Idler	361A270	361A270
5		Screw	5450006	97A23305
1	1	Switch, Snap Action	3720007	90B72768

DEP. QTY. - Recommended minimum parts for depot from which one or more Punch Heads are to be maintained and overhauled.

SITE QTY. - Recommended minimum parts to be kept on site with Punch Heads for immediate service.

RECOMMENDED SPARE PARTS
EM-B1 PUNCH HEAD

DEP. QTY.	SITE QTY.	DESCRIPTION	STOCK NO.	DRAWING NO.
1	1	Arm, Detent	371A1680	371A1680
1		Arm, Feed Pawl	371A896	371A896
1		Arm, Feed Pawl Actuating	371A434	371A434
1	1	Bearing, Paper Feed Eccentric	5006143	97B16942
1	1	Bearing	5006182	97A26198
1	1	Bearing	5006147	97B16955
3	3	Bearing, Interposer Cam Line	5006144	97B16943
1		Detent, Arm Holder	371B1656	371B1656
1	1	Eccentric, Detent Adj. Bracket	371A109	371A109
1	1	Eccentric, Magnet Adj.	371A72	371A72
2	2	Lever, Punch	371A243	371A243
2	2	Lever, Punch Restoring	371A89	371A89
1	1	Line, Punch Eccentric	570036	371B63
1		Line, Reset	371B865	371B865
1	1	Link, Armature and Magnet	371B945	371B945
2	2	Magnet	371A135	371A135
1	1	Magnet, Paper Feed	371C950	371C950
1	1	Pawl, Feed	371A103	371A103
8	1	Pin, Punch (code) .0725-.0727 (chart 371A935)	371X937	371X937
1	1	Pin, Punch (sprocket) .0471-.0473 (chart 371A960)	371X96	371X96
1	1	Pin, Punch (sprocket) .0468-.0470 (chart 371A960)	371X961	371X961
1	1	Pin, Punch (sprocket) .0456-.0467 (chart 371A960)	371X962	371X962
1		Plunger, Spring	371A985	371A985
1		Punch Die Block Assembly	371C81	371C81
5		Screw, Socket Head 6/32 c 1/8	5481009	97A21822
2	2	Screw, Magnet Locking	371A75	371A75
1	1	Shaft, Punch Lever Pivot	371A74	371A74
1	1	Shaft, Punch Restoring Lever	371A69	371A69
2	2	Shim (.005)	371A949	371A949
2	2	Shim (.002)	371A620	371A620
2		Shim (.003)	371A621	371A621
2	2	Shim (.003)	371A617	371A617
2	2	Shim (.005)	371A618	371A618
2		Spacer, Ratchet Wheel (.005)	371A622	371A622
2	2	Spacer, Ratchet Wheel (.002)	5078129	371A619
2		Spacer, Ratchet Wheel (.010)	371A623	371A623
2	2	Spring	371A185	371A185
5	5	Spring	371A1279	371A1279
1	1	Spring, Feed Magnet	371A1252	371A1252
1		Washer, Spacing (.002) (chart 371A674)	5443055	371X671
1		Washer, Spacing (.003) (chart 371A674)	5443056	371X672
1		Washer, Spacing (.005) (chart 371A674)	5443057	371X673
1		Wheel, Sprocket	570037	371C284

DEP. QTY. - Recommended minimum parts for depot from which one or more Punch Heads are to be maintained and overhauled.

SITE QTY. - Recommended minimum parts to be kept on site with Punch Heads for immediate service.

CONTROL DATA SUPPLEMENT NO. 1

to

CONTROL DATA® PAPER TAPE PUNCH (NCR EM-B1/B2)

Customer Engineering Manual

Publication Number 60143600

This supplement describes the procedure for replacing the punch and die block (NCR EM-B1). It should be considered as an addition to the Paper Tape Punch Manual and filed with that manual for ease of reference.

Pub. No. 60211600

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CONTROL DATA
CORPORATION

Rev A

REPLACEMENT OF PUNCH AND DIE BLOCK

Use this procedure when replacing the punch and die block (Figure 5-36, page 5-35). The punch and die block will require replacement when in the opinion of the on-site customer engineer the data is not being punched cleanly (fuzzy information holes), or when the 400-roll criterion is met (paragraph 4.1.4, page 4-5).

SPECIAL TOOLS

None required

LUBRICANTS

NCR 801	CDC P/N 12206170
NCR 803	CDC P/N 12206171
Shell Alvania EP#1	CDC P/N 12206169

PARTS REQUIRED

1. Feed pawl, NCR P/N 371A103 (Figure 1-10, page 1-14)
   CDC P/N 12252506 - supplied as initial spare
2. Detent arm holder, NCR P/N 371A1656 (Figure 5-35, page 5-35)
   CDC P/N 12208481 - supplied as initial spare
3. Punch and die block, NCR P/N 371C81 (Figure 5-36, page 5-35)
   CDC P/N 12251898 - must be ordered

PROCEDURE

Reference Figure 2-6, page 2-6 (Punch Head, Front View)

1. Disconnect plug P1 (power and grounding wiring) from rear of punch and remove mounting screws; relocate punch head to work area.

2. Remove dummy head assembly (also called paper guide) shown in Figure 5-24, page 5-29 (2 screws labeled CP).

3. Remove paper tape guide (2 screws), Figure 2-6.

4. Remove tape guide shoe (2 screws), Figure 2-6.

5. Remove sprocket wheel cover (3 screws), Figure 2-6.

6. Remove chaff chute (3 screws), Figure 2-6.

7. Remove E ring retainer on the punch reset line (3 screws), Figure 1-9 shows reset line. Retainer is located on punch front frame (Figure 2-6). Remove E ring.

8. Remove E ring retainer on the punch eccentric line (3 screws). Retainer is located on punch front frame. Remove E ring.

9. Remove the four shoulder screws near the reset line.

10. Remove the lock nut and washer (located on the punch lever restoring shaft). Figure 4-13, page 4-15, shows location of punch lever restoring shaft.

11. Remove the three screws holding the punch front frame.

CAUTION

These screws are normally well seated and may require the use of a crescent wrench applied near the tip of the screwdriver to break them loose.

12. Remove the sprocket and ratchet wheel (one set screw located on the flat side of the sprocket holds the assembly to the shaft) (Figure 1-10).

    a. Remove the spacer (if applicable) from the sprocket shaft.

    b. Disconnect the magnet link from the feed pawl. It may be necessary to loosen the feed magnet to disconnect the magnet in order to disconnect the magnet link (see Figure 1-10).

    c. Remove the feed pawl and inspect it for signs of wear; primary wear point will be on the surface which contacts the teeth in the ratchet wheel. If evidence of excessive wear (rounded edge), or if in doubt, replace the feed pawl (see item 1 under Parts Required).

d. Thoroughly clean the sprocket and ratchet wheel area. Remove all chad and dirt which may have accumulated.

CAUTION

Do not use any cleaning agents (alcohol, triclor, etc.) while cleaning this punch. A Q Tip with NCR 801 lubricant applied, serves as an excellent cleaner as well as a lubricator. Remove excessive lubricant.

e. Lightly coat the entire feed pawl with NCR 801, and replace the feed pawl.

f. Coat the sprocket shaft with a thin film of NCR 801.

g. Replace the magnet link, spacer (if removed in 12. a) and the sprocket and ratchet wheel. Position the flat side of the sprocket as shown in Figure 1-10.

13. Remove spring holding detent arm holder against ratchet wheel (spring is located behind punch frame). Slide sprocket and ratchet wheel toward punch frame as far as possible (insure feed pawl is clear of ratchet wheel so that the maximum rear-ward position may be obtained. Secure set screw on shaft. Insure flat side of the sprocket is downward. (Reference paragraph 4. 2. 2d, item 1).

a. Remove the detent arm holder (Figure 5-35, page 5-35, and Figure 4-9, page 4-12) by removing the two mounting screws. Inspect detent arm holder for signs of wear; primary wear point will be on the surface in contact with the ratchet wheel (Figure 5-35, item A). If there is evidence of excessive wear (or if in doubt) replace the detent arm holder (see item 2 under Parts Required).

b. Clean area where detent arm holder is mounted (see 12. d.).

c. Use NCR 801 lubricant to coat moving parts in detent assembly; saturate felt wick in detent assembly with NCR 803. Replace detent arm holder using the two screws previously removed.

d. Replace spring which was removed in step 13. If feed magnet was loosened re-tighten prior to proceeding to step 14. Both the feed magnet and the feed pawl adjustments will be performed later.

14. The punch front frame (Figure 2-6) is the next item to be removed. Due to the method of mounting it is necessary to work the frame off the mounting studs. This may be accomplished by lifting one side of the frame and then the other, while continuing to move the frame forward.

CAUTION

While removing the punch front frame, it is required that particular attention be paid to the shaft punch interposer arm (see Figure 5-39, item J). This shaft must not be allowed to come out while the punch front frame is being removed. A punch pin and hammer are recommended to "tap" the shaft to keep it in place.

15. With punch front frame removed, turn punch upside down.

16. Punch levers will now lie in the punch lever comb, and the punch and die block can be conveniently removed.

17. Remove the punch restoring levers by removing the punch restoring lever shaft (see Figure 5-26), the shaft is seated in bracket (item P) and can be readily removed by turning the shaft (item CZ) while applying a forward "pull".

    a. With shaft removed, the punch restoring levers and their respective springs can be removed from the punch pins (caution should be exercised to avoid mixing the respective levers).

    b. Remove the punch and die block (see Figure 5-36) by removing the No. 8-32 x 1/2 long socket head screw mounting the block to the back plate. The punch and die block can now be pulled forward and can be removed.

    c. Remove the punch levers from the punch eccentric line being careful not to confuse the order in which the levers are removed.

    d. Remove the shaft punch lever pivot (item c, Figure 5-33) from the punch lever comb; inspect this shaft for any signs of wear (grooving, pitting). If wear is apparent, a fine grade of emery cloth can be used to remove the defects. If wear is excessive the shaft must be replaced.

    e. Thoroughly clean the punch level comb and surrounding area using the small bristle brush supplied as an initial spare. Apply a thin film of NCR 801 lubricant to the inter-surface of the comb and to the shaft housing.

Apply a thin coating of the 801 lubricant to the punch lever comb shaft, and reinsert shaft.

f. Take the last punch lever removed in step 17. c.; remove old lubricant (reference paragraph 12. d.). Apply a thin film of NCR 801 lubricant to the inter surfaces of the punch lever (bronze bushing). Inspect the punch eccentric line shaft for signs of wear; if wear is apparent proceed as in step 17. d. Clean shaft, and apply a coating of NCR 801 lubricant. Replace punch levers in the order that they were removed after removing old lubricant and re-lubricating each lever.

18. Orientate punch pins in the new punch and die block assembly P/N 12251898 such that the "cut out area" in each punch pin is toward the "inside" of the punch (punch restoring levers when installed will be positioned as shown in Figure 1-9; Figure 4-1 shows this positioning incorrectly).

a. Fill both depressions (wells) in the punch block and die with the Shell Alvania EP #1 lubricant. Apply Shell Alvania EP #1 on the top surface of the punch pins where these pins contact the punch levers.

b. Mount the punch and die block (insure guide pins on back plate are engaged) using the No. 8-32 x 1/2 long socket head screw.

19. Inspect the punch restoring lever shaft for signs of wearing; see step 17. d. Clean shaft, and apply a coating of NCR 801 lubricant. Disconnect springs from each lever and the spring hook (Figure 5-27: AQ). Clean and lubricate each punch restoring lever (reference paragraph 12. d.); in order, proceed to position each lever into the respective pin in the punch and die block. When all nine levers have been so positioned, insert the restorer shaft through all levers, and mount in the bracket (item P, Figure 5-26). Reconnect springs.

20. Punch is now ready to have Punch Front Frame Replaced. Turn punch back to normal position. Inspect punch front frame bearings. Re-install punch front frame -- again caution must be exercised to insure that the frame is mounted as evenly as possible to avoid binding -- a light coating of NCR 801 on the mounting studs will facilitate replacement. When the punch front frame contacts the punch restoring lever shaft (Figure 5-26) this shaft must be worked into alignment with the hole in the frame. Once this shaft, the punch lever shaft and the punch interposer arm shaft are seated in the punch front frame, the 3 screws (step 11) may be used to "pull in" the front frame to its final position. Securely tighten these screws.

a. Replace hardware removed in steps 10, 9, 8, and 7.

21. Perform following adjustments (if required) as called out in paragraph 4. 2. 2L (use . 0015 gauge -- tight fit) if recommended . 0005 gauge not available).

NOTE

This clearance must be maintained across the nine punch restorer levers. If a clearance difference exists between the extremes (front to back) the two mounting screws holding the punch restoring lever bracket (item P, Figure 5-26) must be loosened, and the bracket adjusted to meet this requirement.

22. Replace items removed in steps 6, 5, 4, 3 and 2 using a thin coating of Shell Alvania EP #1 between the punch frame and the tape guide shoe (step 4) as required.

23. Give entire punch head a general clean up and complete the lubrication as follows: (Reference Figure 4-1).

a. Apply NCR #803 lubricant as required to fill the five holes in the side of the punch lever comb (3).

b. Apply a thin film of NCR #801 lubricant to camming surfaces of the punch restoring levers and punch levers (see Figure 4-13).

c. Evenly apply three drops of NCR #803 lubricant on reset line, across surface which cams the punch interposer operating arms (8). The punch interposer, interposer operating arms and punch interposer guide block are lubricated during assembly; excess build-up of lubricant in this area will degrade punch performance.

d. Apply a thin film of NCR #801 lubricant around both ends of the reset line and the punch eccentric line where the lines contact the inner rings of the ball bearings. Also, apply where the line contacts the inner rings of the bearings in the punch frame (12).

24. Remount punch head in cabinet, reconnect power wiring, grounds and cables previously removed.

a. Remove dummy head assembly (see step 2); check the following assembly and operational adjustments.

1) Detenting pressure (paragraph 4. 2. 2e, Figure 4-6). Considering that the special torque tool is not supplied to field installations, and the fact that the eccentric controlling the spring tension has not been adjusted the detenting pressure should not require adjusting, and adjustment is not recommended. A working range for the detenting pressure setting can be obtained by following the procedure below:

   a) Loosen eccentric lock nut.

   b) Rotate eccentric until spring tension is minimum (viewed from rear of machine).

   c) Mark this point on front of punch frame, using the screw slot as a reference, rotate eccentric CW(viewed from front of punch) 90° from reference mark, retighten lock nut.

2) Safety block and feed pawl clearance (4. 2. 2g)

   Manufacturing adjustment -- unless safety stop has been replaced -- do not perform.

3) Feed pawl (4. 2. 2h)

4) Feed magnet setting (4. 2. 2i)

25. Thread tape, and turn punch power on: Feed tape through punch and check feed hole registration, using the paper tape gauge (P/N 12210800 supplied as an initial spare). If tape does not meet gauge specifications proceed as follows:

    a. Feed holes incorrectly spaced (4. 2. 2q); adjust detent arm holder eccentric, (Figure 4-6, paragraph 4. 2. 2e).

NOTE

Adjustment of this eccentric will not require readjustment of detenting pressure (step 24 above).

    b. Tape side registration (4. 2. 2p).

26. Replace dummy head assembly (step 24a).

27. Return used punch and die block to Customer Engineering Returned Goods Section for rework. Scrap used feed pawl and detent arm holder assembly on-site.

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